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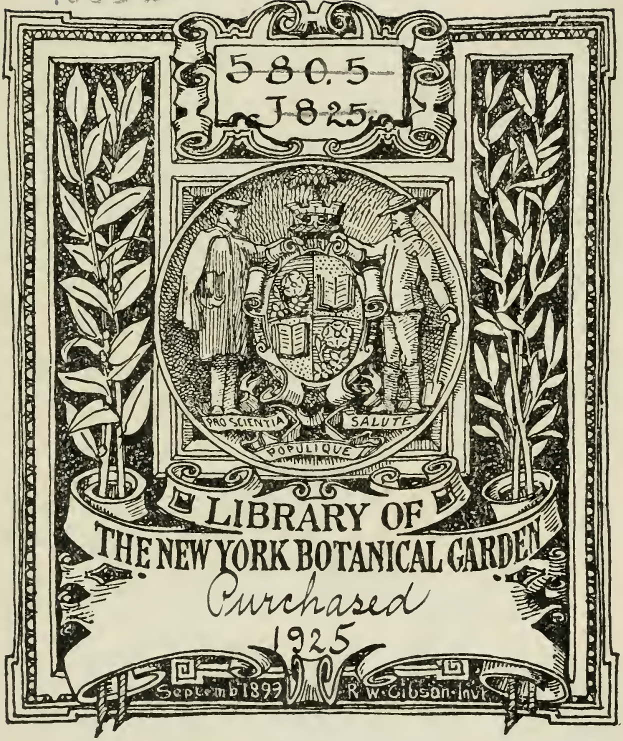
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CORRIGENDA.

P. 8, l. 19, transpose "Mrs." and "Mr."
P. 40, l. 15, for "corrhiza" read "coryza."
P. 67, l. 12, for "test" read "text."
P. 96, l. 23 from bottom, for "Two" read "Three."
P. 107, ll. 2, 3, for "An isomery" read "anisomery"; for "declinous" read "diclinous."
P. 167, l. 23, for "35" read "15."
P. 169, l. 18, for "leaf" read "lip."
P. 170, l. 17 from bottom, after "Domini" add "1640."
P. 171, l. 12, after "them" add "move."
P. 172, l. 8, for "1647" read "1847."
P. 227, l. 6 from bottom, for "*Helleborus*" read "*Helleborine.*"
P. 228, l. 16 from bottom, for "short" read "shoot."
P. 234, l. 11 from bottom, for "forty" read "thirty."
P. 236, l. 8 from bottom, for "1889" read "1869."
P. 257, l. 17, for "unusually" read "usually"; l. 33, *dele* "red."
P. 264, l. 9, for "*retipora*" read "*retepora.*"
P. 275, l. 27, for "S. S." read "L. S."

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No. 685 JANUARY, 1920 Vol. LVIII

THE JOURNAL OF BOTANY

BRITISH AND FOREIGN

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IN MEMORY OF
EDWARD SHEARBURN MARSHALL
(1858–1919)

With Portraits.

Edward Shearburn Marshall was born on March 7th, 1858, in Park Lane, London. He was privately educated, partly in England and partly in Germany, acquiring in the latter country a good knowledge of the language. In September 1873 he entered Marlborough College, where he remained until Midsummer, 1877; while there he obtained an Old Marlburian Scholarship (1876), an Exhibition (1877), and a Scholarship at Brasenose College, Oxford. At Oxford he took a Second Class in Classical Moderations in 1879 and a Third Class in History in 1881, in which year he graduated B.A.; he took his M.A. in 1884. In 1882 Marshall was at Wells Theological College: he was ordained deacon in 1883, and was appointed to the Marlborough Mission at Tottenham as curate; here he remained until 1885, taking priest's orders in 1884.

On leaving Tottenham, Marshall became curate at Witley, Surrey, and it was during his residence there that he married (on August 16, 1887) Miss Fanny Isabel Foster—a niece of the well-known water-colour artist Birket Foster (1825–99), some of whose pictures adorned the Monkton drawing-room. The union was a very happy one, and indeed could hardly have been otherwise, for Mrs. Marshall was a woman of exceptional charm and boundless tact, with an unfailing sense of humour and a brightness which communicated itself to all who came in contact with her. A devoted Churchwoman, she was a centre of parochial life, possessing that gift of sympathy which is not always vouchsafed to earnest workers, with an entire absence of the fussiness which sometimes attends and mars their efforts. She was possessed of considerable musical ability, training the village choir and playing the organ in the church.

Although herself not a botanist, Mrs. Marshall took the keenest interest in her husband's botanical work, especially during their summer holidays in Scotland. It was on one of these occasions that a new Hawkweed was found which was described by Mr. Marshall in this Journal for 1913 (p. 120) as *Hieracium Isabellæ*: the following note is appended to the description:—" I name this striking plant after my wife Fanny Isabel (*née* Foster), in commemoration of our recent 'silver wedding' and in gratitude for her constant sympathetic companionship on so many botanical excursions, over and above the fact that some of the gatherings on which this species is founded were made by her while I was amusing myself by fly-fishing on Loch Ericht, with indifferent success."

In 1890 Marshall became Vicar of Milford, Surrey, where he remained for ten years; it was during his residence here that Mr. S. T. Dunn published his *Flora of South-west Surrey* (1893), in the preface to which Marshall is thanked for "his very kind help and encouragement." In 1900–1902 he was Curate-in-charge of Lavington-cum-Graffham, Sussex, and in 1902–4 Vicar of Keevil, Wilts; towards the end of the latter year he became Rector of West Monkton—a position which he retained until Michaelmas last. He had purchased an estate at Tidenham, near Chepstow, which on account of local association he named "Offa's Dyke," where he had hoped to pass the remainder of his life and to help Mr. Riddelsdell with his Flora of Gloucestershire. But this was not to be.

For some years Marshall had suffered from fits of depression. As time went on, these increased in frequency and intensity: in the summer of 1918 he had a serious nervous breakdown, fainting in the pulpit. He had for some time been complaining that he felt unequal to his clerical duties, and, acting on medical advice, as soon as he recovered from the attack began to make arrangements for resigning his living. The plans were completed in due course, and it was hoped that the withdrawal from clerical work would relieve the pressure, and that the interest of his new surroundings would restore his cheerfulness. But the death of his only brother, to whom he was much attached, and the illness of his wife, deepened his depression. A note which I sent him at the beginning of September was answered by a request that I would not trouble him with botanical matters, and in a subsequent letter he told me that he was giving up botany. I did not take this seriously, but I have since learned that he had withdrawn from membership of the two Exchange Clubs. His wife's death at the beginning of November naturally greatly affected him; in a letter written shortly afterwards—the last I received from him—he gave a sad account of his own condition, and hinted at financial troubles as to which there was not the slightest ground for concern. From this state of despondency Marshall never recovered; he was found lying dead in his room on the 25th of November.

It does not appear that Marshall took up botany at Marlborough, though the school, under the leadership of T. A. Preston, was, at the time of his residence there, keen on the subject: the only reference to him in the Reports of the College Natural History Society is in that for Midsummer, 1877—the year of his leaving,—in connection with ornithology, in which he always retained a strong interest. The Journal of his visit to America (June–August, 1881), which contains numerous small specimens collected *en route*, shows that at that period he had considerable knowledge of plants, and it was probably while at

Oxford that he became interested in botany. On the blank pages of the Journal are lists of species noticed in Teesdale in July, 1883, and of Dorset and Hants plants at the beginning of July, 1884; later in that month he was in the west of France, chiefly in Charente-Inférieure, where he drew up a list; on his return, a stay at Eastbourne for two hours enabled him to note 159 species.

Marshall's first contribution to this Journal, of which he was to become a leading supporter, was in 1885, when he published (p. 311) a short note on *Pinguicula alpina* in Sutherland. The following year saw nothing from his pen, but in 1887 he began the series of notes upon the plants collected during the annual holiday of the preceding year, which have, almost without intermission, formed an interesting feature for more than thirty volumes. I had intended to append to this notice a bibliography of Marshall's contributions, but this would require space which present restrictions make it impossible to afford; I must therefore content myself with a summary of the more important, referring those who want a fuller account to the yearly indexes, in which Marshall's name is always to be found, usually with many references attached.

Before he became a contributor, however, Marshall was a subscriber to the Journal; the first letter the Editor received from him is dated Aug. 31, 1884, and was written while he was stationed at Tottenham. It relates to a review of the third edition of Hooker's *Student's Flora* (Journ. Bot. 1884, 280) and takes exception, on classical grounds, to the statement that "*Tragopon minus* Miller (1768) must replace *T. minus* Fries (1828)." It is written in the *ex cathedra* style which Marshall never entirely abandoned: "Why so, I venture to ask? πώγων is masculine, not neuter: and surely it is most unworthy of any science to perpetuate errors. If the principle of priority is to over-ride the consideration of all linguistic properties in our own day, surely a more critical age will re-revise this arbitrary revision." In common with all intelligent folk, Marshall, as time went on, modified his opinions; it is amusing to find him in 1918 (p. 152) regarding as "unjustifiable" Mr. Lacaita's assertion of the principle thus energetically maintained, and endorsing the view that "the author's spelling, even in extreme cases," should be adopted. Marshall, however, never thoroughly accepted the principle of priority, as may be seen from his notes on *Carex depauperata* (J. Bot. 1896, 229) and *Stellaria umbrosa* (J. Bot. 1904, 152)—the latter a good example of the vigorous style in which he often expressed his opinions. In the letter quoted above he considers that the frequent changes of nomenclature have a deterrent effect upon workers: "I am positive that the services of many who would have done first-rate field work are lost from this one cause. An eager and careful field-worker I can claim to be, as far as time allows, but nothing more; and as such I can't but speak out on behalf of my long-suffering class."

Our correspondence thus begun became frequent and intimate, especially after Marshall went to West Monkton, where, as he told me, he intended to remain for the remainder of his clerical life. About ten years ago he invited me to visit him there, and thus began a personal friendship, not only with Marshall but with his family, which year by year became more cordial. All who had the pleasure of knowing Mrs. Marshall and of sharing in the life of the Rectory will understand how greatly these visits were enjoyed by the guest; and it was pleasant to know that the appreciation was shared by his hosts. Those who were present at the dinner given in June 1913 to the Editor by a representative body of contributors in commemoration of the jubilee of this Journal will remember the genial speech in the course of which Marshall referred to my visits. The large grounds of the Rectory included within their limits a wood of some extent, a pond and small stream, an ample lawn, a rock-garden (to which a second was added by the Marshalls), a carriage-drive, bordered on one side by a field in early spring golden with daffodils and on the other by a wide irregular flower-bed, a kitchen-garden with flower-borders in the old-fashioned style, and an orchard. There was of course no set bedding, but the borders were filled with an astonishing variety of flowers of all sorts, including some of chiefly botanical interest and many not commonly met with—the whole presenting a charming informality. I doubt whether any garden ever gave more pleasure, either to its possessors or to its visitors; not once but many times a day did we walk in it, nor did the walks ever lose their charm.

Marshall's contributions to the Journal have been, as its readers know, very various: descriptions of new forms, biographies, reviews, and an infinity of short notes on points of special interest, came rapidly from his pen. Among the most interesting are the lists of the plants, already referred to, collected during his annual holiday; this was usually spent in Scotland, often with his old friends Mr. F. J. Hanbury and Mr. W. A. Shoolbred, whose names sometimes appear as joint authors of the lists; other companions of his excursions, besides his wife and family, were Mr. S. H. Bickham, the brothers Linton, and Mr. C. E. Salmon. The lists, it need hardly be said, are no mere enumerations of species, interesting only as records of the local flora, but abound in notes of value; as they were not published until the following year, there was time for examination and comparison of specimens before the results were printed. In 1895 and 1906 Marshall visited various parts of Ireland—a country which sometimes attracted him for snipe-shooting: in 1896–7 he was in Wexford, where he found *Sisyrinchium californicum* in such quantity as to convince him "that we have here an instance of survival from an earlier flora, and not an adventitious plant" (J. Bot. 1898, 49). His last visit to Ireland was to South Kerry, accompanied by Mrs. Marshall, with a special view to the Saxifrages, of which he had then begun to make a special study with a view to undertaking them for the *Cambridge British Flora*. A further expedition in search of these, in which I was to have accompanied him, was planned for 1915, but was prevented by the War. Shorter visits were paid to numerous counties: he visited Westmorland and Cornwall with R. P. Murray; Kent with Mr. Hanbury, when the *Flora of Kent* was in preparation; Cardiganshire (1899), Carnarvonshire (1912), and others. Even the briefest visit to a locality previously unknown to him afforded an opportunity for observation and collecting; thus "some hours" at Hayling Island enabled him to examine the various forms of *Salicornia* and to note other things of which a record will be found in J. Bot. 1901, 144; even a wait between trains was utilised. When it is remembered that Marshall was a keen fisherman, and also that he himself dried his often very numerous gatherings, it will be understood that his "holidays" were by no means periods of rest, except such as is afforded by change of occupation. How thoroughly he investigated the plants of his county the "Somerset Plant-Notes" which have appeared annually in this Journal since 1907 sufficiently show. The notes relating to critical genera such as *Hieracium* and *Rubus*, and later *Saxifraga* and *Euphrasia*, give, as has already been said, a special value to Marshall's lists; few have seen so many British and Irish plants growing in their natural conditions, and none have turned their knowledge to better account.

Although possessed of a very adequate knowledge of British phanerogams in general, Marshall paid special attention to certain genera besides those just mentioned, among them *Erophila*, *Viola*, *Epilobium*, *Salicornia*, and *Carex*. It was principally among these that he found material on which to base the new forms which he described in this Journal—e. g. *Ranunculus petiolaris* (J. Bot. 1892, 289—a name afterwards changed to *scoticus*), *Cochlearia micacea* (1894, 289), *Viola* × *Smithiana* (1915, 361), *Helianthemum* × *Bickhami* (1913, 182), *Stellaria umbrosa* var. *decipiens* (1902, 215), *Saxifraga Drucei*, *S. Sternbergii* var. *gracilis*, *S. hypnoides* var. *robusta* (1918, 65–7), *S.* × *Crawfordii* (1909, 98), *Epilobium* × *Waterfallii* (1916, 114), *Hieracium anfractuosum* (1892, 18, 183), *H. dovrense* var. *spectabile* (1894, 216), *H. Isabellæ* (1913, 120), *H. Shoolbredii* (1913, 122), *Salicornia disarticulata* var. *humifusa* (1915, 361). The last is associated in my mind with Marshall's enthusiasm as a collector: we had started in the morning for Dawlish Warren, but arrived at Exeter in such pouring rain that Mrs. Marshall and I preferred to explore the city rather than to face an expedition; Marshall, however, persevered, and was rewarded with a tinfull of Salicornias which he showed us with triumph when he arrived in the afternoon, wet and weary, at Exeter Station.

Marshall's critical notes on the genera mentioned and on others, scattered through his lists, also supplied material for special articles. A warm defence of the "critical" as against the "lumping" school will be found in his account of *Cochlearia micacea* (J. Bot. 1894, 290), where he speaks of the "Benthamic" treatment as "hardly calculated to increase knowledge or promote accuracy" and condemns "Mr. N. E. Brown's crude and offhand dismissal of the *Epilobium* hybrids" and "Sir J. D. Hooker's laconic condemnation of the Hanburian *Hieracia*." "For my own part," he continues, "I think that field-botanists have some ground of complaint when careful and deliberate conclusions, arrived at as the result of long research in the open, the garden, and the study, are hastily tossed as worthless, without their properly investigating the matter, by those whose expressions of opinion deservedly carry great weight, and whose reasoned criticisms would be very valuable." His own notes were always based, as far as was possible, on abundant material: thus he prefaces the "*Epilobium* Notes" (J. Bot. 1890, 2–10), written when he was at Milford, by saying: "During the past season I have examined many thousands of living specimens, paying special attention to hybrids," of which several new to the British Flora were obtained and two new ones (*E.* × *Surreyanum* and *E.* × *anglicum*) described: this paper is an excellent example of Marshall's careful and critical work. The publication by C. B. Clarke on p. 225 of the same volume of *E. Duriæi* as "a new (?) English plant" led to one of those controversies that sometimes enliven the most serious journals, in which both contributors maintained their respective views with some warmth (see J. Bot. 1890, 296; 1891, 78, 106; 1893, 20); the controversy finally developed into a discussion of hybridity—a subject to which Marshall paid much attention; a note on a hybrid *Epilobium* appeared as recently as 1918 (p. 332). In later years he was especially interested in *Saxifraga*, of which he grew many specimens, brought from Ireland and elsewhere, in the portion of his garden devoted to experimental growths: he regarded his papers (J. Bot. 1917, 151–161; 1918, 65–67)—the result of many years' observation—as examples of his best work.

It was appropriate that Marshall's name should be associated with two of his favourite genera, and that this should have been done by those who were not only experts in those genera but also members of his own profession. It may be noted in passing that, from the days of William Turner (†1568), who is regarded as its "father," the clergy of the Established Church have been among the chief promoters of English botany—John Ray (1627–1705) stands out as their most eminent example—and a catena of their number might be made reaching to the present time: William Williamson Newbould (1819–1886), himself retiring to a fault and unrepresented in literature, probably did more than anyone to stimulate the study of critical plants. Contemporary with Marshall and fellow-workers with him were Richard Paget Murray (1842–1908), William Richardson Linton (1850–1908), Augustin Ley (1842–1911); the Rev. W. Moyle Rogers and the Rev. Edward F. Linton still happily with us: William Henry Purchas (1823–1903), Thomas Arthur Preston (1833–1905), and William Hunt Painter (1835–1910), although contemporary, were less associated with Marshall than those already named. The Rev. H. J. Riddelsdell, though also contemporary, from whom much may be expected, belongs to a somewhat younger generation of clerical botanists, of which he is apparently the sole representative; it may be hoped that others in the ranks of the clergy will arise to carry on the tradition, but of this no sign is yet apparent.

The two plants named after Marshall were both collected by himself: *Hieracium Marshalli*, described by the Rev. E. F. Linton (Journ. Bot. 1891, 271) was discovered by him on rocks by the Unich Water, Forfar, in 1888; *Rubus Marshalli*, first described (Journ. Bot. 1892, 340) as *R. Koehleri* var. *hirsutus* and raised to specific rank by Focke and Rogers (Journ. Bot. 1895, 103) was observed by him in company with Mr. Moyle Rogers at Munstead and Witley, Surrey, in 1890, where "it is quite a marked feature of the bramble flora." Other critical species were founded on material collected by Marshall—e. g. *Rubus hesperius* and *R. iricus*, two Irish species described by Mr. Moyle Rogers in J. Bot. 1896, 504–6. Haussknecht gave his name to a hybrid *Epilobium* (*E. Marshallianum* Hausskn.).

Although Marshall's work finds its chief record in this Journal, it was by no means confined thereto. It is to him that we are indebted for the publication of the *Flora of Kent* (1899) on which the joint author and originator, Mr. F. J. Hanbury, had been working since 1872. In the preface to the book Mr. Hanbury expresses his regret "for so long a delay," and continues: "Had not his friend and co-editor kindly consented to bring the critical portion up to date, recast the mass of accumulated facts into final shape for press, and correct the proofs, the Flora could not even now have appeared. He desires to pay his highest tribute to the energy and untiring work that his colleague has thus ungrudgingly given, as well as to the excellent critical field-work which, with little time at his disposal, he has managed to accomplish." Botanists will regret that Marshall was not also called in to complete Mr. Hanbury's *Monograph of the British Hieracia*, which, after the issue of eight numbers at dates ranging from 1889 to 1898, remains a splendid fragment of what might have been. In 1901 Marshall prepared for the Victoria County History (published in 1908) an account of the Phanerogams of Kent—a careful and interesting epitome of the *Flora.*

In 1914 was published the *Supplement to the Flora of Somerset* (see Journ. Bot. 1914, 220), which was undertaken by Marshall at the request of the Somersetshire Archæological and Natural History Society, of whose Botanical Section he was President and in whose Transactions (lix. part 3) it first appeared. He took great interest in the Society, joining in its excursions and presenting to its herbarium, preserved in the Taunton Museum, specimens of his Somerset plants. In the preface to the *Supplement* Marshall refers to R. P. Murray, the author of the *Flora*, whose acquaintance he had made when at Wells, as his "first real helper in the study of critical plants . . . . we were intimate friends from the autumn of 1882 until his death" in 1908: a more detailed acknowledgement will be found in the notice of Murray contributed by Marshall to this Journal for 1909, p. 1.

The account of *Betula* (one of his favourite genera) in the *Cambridge British Flora* (1914) must also be mentioned among Marshall's publications. His help is, moreover, acknowledged in various publications, *e. g.* in *The Flora of Bristol*, where Mr. White pays a warm tribute to his critical knowledge; the Reports of the two Exchange Clubs, of both of which he was a member—he joined the B. E. C. in 1892 and the Watson Club in 1900—contain numerous notes on plants which had been referred to him for his opinion.

Almost from the beginning of his botanical career, Marshall was intimately acquainted with the leading British botanists. Some of them, as has already been mentioned, shared his summer holiday; others were entertained at the rectory or were themselves his hosts, or joined him on short excursions. He was accustomed to speak with especial pleasure of a visit to Cambridge in 1911, when he was entertained by his friend Professor Seward; on this occasion he took part in excursions in that county, in Suffolk, and in Huntingdonshire in company with Dr. Moss and E. W. Hunnybun, and met Mrs. Gregory and the Cambridge botanists. Marshall was a delightful companion on an excursion, and his enjoyment on such occasions was shared by those who accompanied him. His contributions to the Journal contain references to visits to H. C. Levinge (†1896) at Mullingar, to W. B. Boyd (†1918) at Melrose, to the Corstorphines at Arbroath, to Dr. J. Cosmo Melvill and many others; he stayed with Prof. Balfour at Edinburgh, and exchanged visits with his old friends Messrs. Shoolbred and Hanbury and the clergy who have already been mentioned, as well as with Mr. Spencer Bickham, from whose garden he received many interesting things which he returned in kind—for Marshall was as generous with living plants as he was with dried specimens. With botanists nearer home he was in cordial relations, especially with Mr. J. W. White, of Bristol, whose *Flora* he reviewed in this Journal for 1912 (p. 232); his Somersetshire work brought him into contact with Mrs. Downes, Miss Roper, Mr. Sandwith and others and his near neighbours Mr. W. Watson of Taunton and Mr. W. D. Miller of Cheddon—the latter rendered him much assistance and was a frequent companion of his rambles. His infrequent visits to London afforded opportunities for coming into touch with the botanists of Kew and of the National Herbarium; others he met at the rooms of the Linnean Society, of which he became a Fellow in 1887. Indeed, to enumerate all Marshall's botanical acquaintances, either personal or by letter, would be to give a list of contemporary British botanists: to those already mentioned may be added W. H. Beeby (1849–1910), a friend since 1884, of whom Marshall wrote a memoir in this Journal for 1910 (p. 121); Mr. R. W. Scully, whose *Flora of Kerry* he reviewed in this Journal for 1917 (p. 56); the Messrs. Groves; Mr. F. N. Williams; Dr. Druce; Dr. Moss; Mr. Pugsley; Mr. Hiern; Mr. A. B. Jackson—the enumeration might be indefinitely extended.

In 1911 Marshall was elected an Honorary Fellow of the Botanical Society of Edinburgh, "in recognition of his great services to British Botany." The distinction gave him legitimate pleasure, for the number of British Honorary Fellows is limited to six.

In politics Marshall was a strong Tory; he was indeed a man of strong views upon most subjects, and when he had arrived at a conclusion—which he sometimes seemed to base on insufficient data—it was not easy to induce him to abandon it. An example of this will be found in his discovery of *Festuca heterophylla* at Witley in Surrey, which he announced (J. Bot. 1889, 95) as "a new British *Festuca*." The unlikelihood of this South European species being native in England was pointed out by Mr. Carruthers (*op. cit.* 216), who showed that the plant had long been on sale as a pasture grass; Marshall, however (p. 249), warmly defended his position, and maintained at considerable length (J. Bot. 1890, 47–51) his "decided opinion" in favour of its nativity, although "a friend" (W. H. Beeby, who accompanied Marshall to the station—see J. Bot. 1895, 253) questioned this. Nine years later, however, Marshall himself (J. Bot. 1899, 357) expressed his conviction that "Mr. Beeby was right in considering *Festuca heterophylla* as probably introduced at Witley."

I detail the incident at some length because it shows that Marshall, although difficult to convince, was willing to own up when he *was* convinced, and also because it illustrates his somewhat over-readiness to regard as British, plants whose antecedents suggested the improbability of this—*Sisyrinchium californicum*, already mentioned, is a case in point. On the other hand, he did much towards establishing the claims of plants whose nativity had been regarded as doubtful—*e. g.* the one standing in our books as *Aconitum Napellus*; this he regarded as "a true native in Somerset and in several other western counties" (Fl. Som. Supp. 8), and it was difficult to regard it as otherwise in the stations where he showed it to me. Marshall was also a staunch defender of the nativity of *Pæonia corallina* and *Allium Ampeloprasum* on the Steep Holm—of which R. P. Murray gives the flora in J. Bot. 1891, 269; he made several excursions to the island and introduced from it to his garden the two plants above mentioned: he also regarded *A. triquetrum* as native in Cornwall (J. Bot. 1918, 56).

His views as to specific rank also underwent modification: thus the *Ranunculus* first mentioned by him (J. Bot. 1889, 230) as *R. Flammula* var. *petiolaris* and subsequently published and figured (J. Bot. 1892, 289, t. 328) as *R. petiolaris*—a preoccupied name for which *R. scoticus* was substituted (J. Bot. 1898, 103)—was later (J. Bot. 1900, 185) "after much consideration" regarded as a subspecies —a view which had been previously urged upon him by Mr. Arthur Bennett and other botanists.

It seems right to add that, although so much of his time was devoted to botany, Marshall's clerical work was in no way neglected: the ordinary duties of a country clergyman, which are perhaps more numerous than is sometimes supposed, were conscientiously and methodically performed. His parish, though straggling, was not a large one, as reckoned by inhabitants, and he had the help of a curate, but he took his full share of work, usually preaching twice on a Sunday. His sermons were much appreciated by the more educated members of his flock, but were, I gathered, regarded by the poorer classes as rather over their heads—"too clever," as one of them expressed it. Marshall was a thorough "Church and State" man—a moderate High Churchman of the degree indicated in the Anglican thermometer as "E.P. and altar lights," but with no sympathy with the more advanced members of that school. Although he did not readily brook contradiction, he was a most pleasant companion.

It would be presumptuous on the part of one who claims no high position among British botanists were he to attempt to estimate that which Marshall had attained. But a letter received since his death, from one who himself stands in the first rank of our botanists, contains an appreciation which appears to me so just that I propose to print it in place of expressing any opinion of my own:

"His death is a great loss to British Botany. He was unsurpassed as a collector of the critical flowering plants, both in point of the number of interesting things he found and the care and judgement he showed in selecting and pressing specimens of them. He was most generous in distributing his specimens, and it was always a delight to receive a parcel from him, for it was sure to contain many plants of interest. He was, I think, much more apt in seeing differences than likenesses, but if one felt sometimes that he was a little inclined to regard his geese as swans, he always furnished his friends with adequate material to form a judgement for themselves. It is very sad that he should have dropped out so early from the comparatively small band of good critical botanists."

With regard to Marshall's specimens, those who shared his holiday excursions tell stories of the shifts to which he was sometimes put to carry out the process of drying satisfactorily, and of the trouble and time he devoted to the work. At home it was no uncommon thing for him to change the papers six times a day, beginning before breakfast and ending late at night. He took great care in spreading out leaves and flowers, adjusting pads for thick stems, and in all the little details which go to make up perfect specimens. His labels, too, were models of neatness and exactness, and his numbering each plant distributed made reference easy; his distribution numbers reached about 4500.

Besides the set which he always laid aside for the National Herbarium, which is thus possessed of a series almost as complete as his own, and his liberal donations to private correspondents, Marshall contributed largely to the two Exchange Clubs; he also helped in providing the specimens sent out by the brothers Linton in their sets of *Hieracia* and *Salices*.

Marshall was also a good and prompt correspondent—a fact of which amateurs as well as botanists took full advantage. I have often heard him say, when opening at breakfast a packet of plants sent to name—"Oh, I really *can't* be bothered with these things to-day!" and I heard it with amusement, for I knew that before the afternoon post went out, the specimens would be named and the packet returned with a useful and encouraging letter—sometimes, however, with a complaint of the insufficiency of the material supplied: the poorness of the specimens often sent out even by botanists of repute always irritated him, as was not unnatural in one who was himself beyond reproach in that respect. There is no need to say how good his letters were: most British botanists can from their own knowledge bear witness to the fact. It may be noted incidentally that Marshall had a considerable correspondence with critical botanists on the Continent; in the course of his contributions to this Journal will be found references to letters from Haussknecht, Lange, Kükenthal, Wettstein, Focke, Domin, von Sterneck, and others.

Marshall was a very careful writer; not only was his style clear and concise, but his manuscript practically required no correction before sending to press—a testimonial which, as every editor knows, is rarely given or deserved. He was careful, too, in his references; he had a small but useful botanical library of which he made good use, and would often ask me for extracts from books which were inaccessible to him. His occasional visits to town found him at the

National Herbarium or at the Linnean Society for the consultation and comparison of books and specimens necessary for his work. In everything connected with his herbarium—as, indeed, in other respects—Marshall was exceedingly methodical: the ample space of the Rectory enabled him to devote a room to the accommodation of his plants and books, and things not dealt with at once were carefully endorsed—*e. g.* some papers which I had sent him for notice came back to me after his death labelled "Important: for review in J. of. B. after settling at Offa's Dyke."

This tribute to Marshall's memory has run to greater length than I had anticipated, but I do not think that those who knew him, either personally or by correspondence, will consider it too long: rather will they note omissions which they would have been able and willing to supply. By his death, the Editor has lost a valued friend and the Journal a principal contributor, and this memoir may fittingly conclude with a reference to the assistance rendered by Marshall to both at a critical period. It will be remembered that owing to the War and other circumstances a serious deficit was experienced at the end of 1916. By the generosity of friends and in response to a circular signed by five leading British botanists, the deficit was made up, as stated in the volume for 1917, p. 143; but it could not then be said that the circulation of the appeal, the receipt and acknowledgement of subscriptions, and other incidental trouble was entirely undertaken by Marshall, who was also, with his wife, the most liberal subscriber.

James Britten.

(The accompanying portraits are from a photograph taken in July 1919.)

LLANBERIS LICHENS.

By J. A. Wheldon.

The following list was compiled in the district around Llanberis between the 3rd and the 8th of August. In company with the Misses Armitage and Cobbe, and Messrs. Druce, Jones, Rhodes and Travis, a considerable proportion of that time was devoted to the examination of the Phanerogams and Bryophyta of the vicinity. Two days were somewhat spoiled by unfavourable weather. The list cannot, therefore, be regarded as an exhaustive one, and many of the lichens known to occur in the district were not seen at all. Others, such as *Cerania vermicularis*, were unexpected, because not recorded in the *Flora of Carnarvonshire* or Leighton's *British Lichens*, and it is singular that so conspicuous a species, occurring close by the path from Llanberis to the Snowdon summit in some abundance, should have been overlooked. The comparatively few corticole species included, is due to the fact that most of our time was spent on the hills, above the tree zone, and not to any poverty of species in this group. The arrangement is that of A. Lorrain Smith's *British*

Lichens; and species not recorded for Carnarvonshire in Griffith's *Flora* are indicated by an asterisk:—

Sphærophorus globosus A. L. Sm. Frequent on boulders.—*S. fragilis* Pers. On Clogwyn and Cwm Glas, frequent.

Ephebe lanata Wain. Damp shady rocks near Llanberis Castle.

**Polychidium muscicolum* S. F. Gray. Mossy boulder on Snowdon.

Pannaria pezizoides Light. Near the stream by Crib Coch.

Peltigera canina Willd. Llanberis; Cwm Glas and Snowdon.—**P. polydactyla* Hoffm. Banks in Llanberis Pass and below Clogwyn.—*P. aphthosa* Willd. Shaded banks in Llanberis Pass.

Solorina saccata Ach. Damp ledges on volcanic ash. Cwm Glas.

Parmelia physodes Ach. Common, with forms *labrosa* and *recurva*.—*P. pubescens* Wain. Snowdon at about 2550 ft.; sparingly near Clogwyn Tarn.—*P. perlata* Ach. Frequent near Llanberis.—*P. caperata* Ach. Very fine on both trees and rocks.—*P. proboscidea* Tayl. Sparingly on trees near Llanberis Castle.—*P. saxatilis* Ach. and forma *furfuracea* Schær. General, on trees and rocks.—*P. cetrarioides* Del. Rocks at foot of Snowdon, above Llanberis Falls.—*P. sulcata* Tayl. Noted only once on a wall near Nant Perris.—*P. lævigata* Ach. Rather frequent on boulders and trees near Llanberis.—*P. revoluta* Floerke. On mossy boulders near Llanberis Falls.—*P. conspersa* Ach. Common and fruiting well about Llanberis; var. *stenophylla* Ach. near the Castle. f. *isidiata* Leight. On boulders at the foot of Snowdon.—*P. omphalodes* Ach. Very frequent throughout the district, and occasionally fruiting well.—*P. fuliginosa* Nyl. Common on rocks and walls. The var. *læte-virens* Nyl. frequent on trees.

Cetraria glauca Ach. Common on both rocks and tree-trunks.—*C. islandica* Ach. Sparingly in Cwm Glas, and on Snowdon at 3250 ft., var. *tenuifolia* Wain. Amongst *Racomitrium lanuginosum* at about 3500 ft. on Snowdon.—*C. aculeata* Fr. Common, ascending to the summit of Snowdon.

Evernia prunastri Ach. Tree-trunks at Llanberis.—*E. furfuracea* Mann. On a wall at the foot of Cwm Glas.

**Usnea hirta* Ach. Trees near Llanberis.—*U. ceratina* Ach. On rocks in Llanberis Pass.

Alectoria bicolor Nyl. Near the summit of Snowdon and in Cwm Glas.—**A. chalybeiformis* Th. Fr. Snowdon at above 3000 ft.

**Cerania vermicularis* S. F. Gray. On the bare shoulders of Snowdon immediately below the Summit Station, in some abundance, and ranging between 3200 to 3500 ft. or higher. It occurs on ground covered with small stones, associated with *Salix herbacea*, *Racomitrium lanuginosum*, *Anthelia Juratskana*, *Marsupella ustulata*, *Cladonia uncialis* var. *turgescens*, *Lecidea demissa* and other alpine species.

Xanthoria parietina Th. Fr. Occasionally on walls, gate-posts, and rocks, especially near villages and farms.

Placodium pyraceum Anzi var. *pyrithromum* A. L. Sm. An athalline form on a foreign white thallus, the apothecia in small groups, amongst decaying mosses above 3000 ft. on Snowdon.—*P. ferrugineum* Hepp. Very sparingly on a tree near the Castle.

Candelariella vitellina Müll.-Arg. Frequent around Llanberis.

Physcia pulverulenta Nyl. Somewhat rare on trees in Llanberis Pass.—**P. stellaris* Nyl. var. *cercidia* Nyl. Observed once near Nant Perris.—*P. hispida* Tuckerm. Frequent, the f. *leptulea* (Ach.) on trees, and f. *tenella* (Scop.) on rocks near Llyn Padarn.

**Rinodina demissa* Arn. On slate near Llyn Padarn.

Lecanora gelida Ach. Rocks in Llanberis Pass and above the tarn in Cwm Glas Mawr.—*L. subfusca* Ach. var. **chlarona* Ach. Trees near Llanberis. Var. *allophana* Ach. Trees near the Castle.—*L. rugosa* Nyl. Apparently rare, seen once on trees near Llanberis.—*L. atra* Ach. Frequent, and ascending to 3500 ft. on Snowdon.—**L. Hageni* Ach. On small stones in Llanberis Pass.—**L. carpinea* Wain. On branches of trees, frequent.—**L. varia* Ach. Sparingly on old worked wood near Llanberis.—**L. farinaria* Borr. var. *conizæoides* A. L. Sm. On larch near Llanberis.—*L. sulphurea* Ach. Rocks and walls in Llanberis Pass and below Cwm Glas.—**L. epanora* Ach. Noticed in several places in Cwm Glas, and on the ascent of Snowdon from Llanberis.—*L. polytropa* Schær. Seen very sparingly on Snowdon.—*L. badia* Ach. Frequent on boulders, Llanberis Pass, Snowdon, and below Clogwyn.—**L. atriseda* Nyl. Wall in Llanberis Pass, with *Lecidea geographica*.—*L. tartarea* Ach. Frequent, and fruiting well on tree-trunks and rocks; the var. *frigida* Ach. on Snowdon above Cwm Glas Mawr.—*L. parella* Ach. Occasional on walls and rocks.—*L. lacustris* Th. Fr. Abundant on stones below Llanberis Waterfall, and at intervals in the bed of the stream down to the lake.—*L. Dicksonii* Nyl. Frequent, ascending from near the Llyn Padarn to the summit of Snowdon.

Acarospora fuscata Th. Fr. Rocks in Cwm Glas.—**A. smaragdula* Massal. Rocks below Clogwyn.

Pertusaria globulifera Nyl. Rare, on trees near Llanberis.—*P. faginea* Leight. Rather frequent on trees.—**P. multipuncta* Nyl. Trees near the base of Snowdon, rare.—**P. lactea* Nyl. Frequent, but always sterile, ascending to the summit of Snowdon.—*P. communis* Dalla Torre and Sarnth. Only noticed once on a tree near Llanberis.—*P. dealbata* Cromb. Boulders in Llanberis Pass. Frequent on Snowdon and Clogwyn.—*P. leioplaca* Schaer. Trees near Nant Perris.

Crocynia lanuginosa Hue. Shady mossy wall in Llanberis Pass.

**Racodium rupestre* Pers. Rocks in Cwm Glas.

Gyrophora polyphylla Hook. f. *congregata* T. & B. Rocks below Clogwyn, and near the foot of Crib Goch.—*G. cylindrica* Ach. Near the summit of Snowdon and on rocks below Clogwyn. forma *denudata* Mudd and var. *fimbriata* Ach. Clogwyn. *Var. *denticulata* Ach. Rocks above Cwm Glas near the summit of Snowdon.—**G. torrefacta* Cromb. Observed very sparingly below Clogwyn.

Bæomyces roseus Pers. Seen in a sterile condition only on Snowdon.—*B. rufus* DC. Rocks in Llanberis Pass.

Stereocaulon condensatum Hoffm. With *Cerania vermicularis* at 2250 ft. on Snowdon.—*S. coralloides* Fr. Snowdon.—**S. evolutum* Graewe. Frequent on walls and rocks.—*S. denudatum* Floerke. Cwm Glas and Clogwyn, rather frequent. *Var. *pulvinatum* Th. Fr. Rocks above 3000 ft. on Snowdon. and on boulders near Nant Perris.

Cladonia sylvatica Hoffm. Very frequent.—*C. uncialis* Web. Frequent. The var. *turgescens* Fr. and *f. *obtusata* Ach. high up on Snowdon, rare.—*C. pyxidata* Hoffm. Banks and walls near Llanberis. Var. *chlorophæa* Floerk. and *f. *lepidophora* Floerk. on walls in Llanberis Pass.—*C. fimbriata* Fr. form *macra* Floerk. With the preceding, and also *var. *subcornuta* Nyl. f. *antilopæa* (Mudd).—**C. lepidota* Nyl. f. *hypophylla* Cromb. Cwm Glas, Clogwyn, and on Snowdon near the railway at 3500 ft.—*C. cervicornis* Schaer. Common on rocks and boulders.—*C. sobolifera* Nyl. Cwm Glas. I do not understand the limitations of this and the preceding. The plant we have always called *C. cervicornis* invariably gives a very distinct yellow reaction with KHO, and I have referred all those without such reaction to *C. sobolifera*.—*C. gracilis* Willd. Frequent on walls and mossy rocks.—*C. furcata* Schrad. Cwm Glas.—*C. digitata* Hoffm. Near Llanberis Castle.—**C. squamosa* Hoffm. Mossy wood in Llanberis Pass.—*C. coccifera* Willd. Clogwyn and Cwm Glas.—**C. flabelliformis* Wain. Mossy boulders above Llanberis Falls.—**C. macilenta* Hoffm. Wood near Llyn Padarn.

Lecidea demissa Th. Fr. Snowdon at 3250 ft.—*L. lucida* Ach. Walls between Llanberis and Nant Perris.—*L. coarctata* Nyl. var. *elacista* Cromb. Slaty rocks below Clogwyn. Var. *glebulosa* Cromb. Llanberis Pass and amongst decaying hepatics &c. near the summit of Snowdon.—**L. granulosa* Schaer. and **L. uliginosa* Ach. Cwm Glas.—*L. parasema* Ach. Trees near Llanberis.—**L. goniophila* Schaer. Rocks below Clogwyn and on Snowdon at 3300 ft.—**L. leucophæa* Nyl. Snowdon above 2000 ft.—*L. consentiens* Nyl. Snowdon at about 3000 ft.—*L. contigua* Fr. Abundant on rocks, walls, and small stones, with the var. *flavicunda* Nyl. A form with minute apothecia occurs.—*L. sorediza* Nyl. Rare. Rocks below Clogwyn.—*L. confluens* Ach. Common, with f. *oxydata* Leight. The var. *rimoso-areolata* Leighton on Snowdon.—*L. lapicida* Ach. Boulder in Llanberis Pass; Snowdon.—*L. lithophila* Ach. Snowdon at 3250 ft., f. *ochracea* Floerk., on rocks below Clogwyn.—**L. plana* Nyl. Cwm Glas and Clogwyn.—*L. lactea* Floerke. Rocks near the Snowdon railway at about 3300 ft.—*L. aglæa* Sommerf. Rocks below Clogwyn.—*L. rivulosa* Ach. Frequent, and often associated with *Lecanora badia* and the next species.—*L. Kochiana* Hepp. Ascends to above 3250 ft. on Snowdon. The var. *lygæa* Leight. occurs on rocks below Clogwyn.

Megalospora sanguinaria Massal. Boulders in the wood near Llanberis Castle.

Biatorina lenticularis Koerb. var. *acrustacea* Hepp. Rocks on Snowdon at about 2300 ft.—*B. contristans* A. L. Sm. On decaying *Andreæa* near the summit of Snowdon.

***Bilimbia cambrica**, sp. nov. Thallus indeterminatus granulato-squamulosus vel squamulosus, squamulis contiguis vel dispersis flavido-cinereis, marginis prominentes pallidioribus. Apothecia nigra primo plana marginata deinde convexa immarginata et ætate tuberculata, sæpe conglomerata. Epithecium in plagas tenues dissectum brunneum. Hypothecium saturate nigro-fuscum. Paraphyses bene discretæ subcapitatæ graciles, apicibus fuscescentibus. Spori 24–36 × 5–7 μ fusiformes 3-septatæ.

Thallus yellowish grey, subeffuse, squamulose, squamules roundish and nodulose or larger and irregularly flexuose, adnate, depressed in the centre, whitish at the elevated margins, scattered or congregate. Apothecia rather small, black, opaque, scattered or several together, in age convex and tuberculate with the margin excluded. Epithecium brown in section; hypothecium black, becoming brown upwards. Paraphyses slender, subcapitate. Spores fusiform, 3–5 septate; 24–36 × 5–7 μ. On rocks of volcanic ash on Snowdon, above 3000 ft. This lichen is very near *Bilimbia leucophæopsis* A. L. Sm., the only locality for which is on Ben Lawers. Like that species it is associated with *Sirosiphon saxicola*, which forms dark patches between the thalline squamules. It may be only a variety of that species, but is distinguished from it by the whitish margins of the squamules, and the darker thallus.

Bilimbia melæna Arnold. On decaying mosses and hepatics on Snowdon.—*B. lignaria* Massal. Encrusting decaying mosses high up in Cwm Glas, and over-running *Cladoniæ* and mosses amongst *Cerania* on Snowdon.

Bacidia umbrina Branth & Rostr. Rocks in the wood by Llyn Perris, vars. *turgida* Th. Fr. and *compacta* Th. Fr. On walls amongst small mosses in Llanberis Pass.

Buellia myriocarpa Mudd. On a tree-stump near Llanberis.—*B. colludens* Tuck. Rocks in Cwm Glas.

Rhizocarpon geographicum DC. Common, with forms *contigua* Leight. and *urceola* Leight.—**R. Œderi* Koerb. Boulders in Llanberis Pass, on Clogwyn, and near the summit of Snowdon.—*R. petræum* Massal. By the lake in Llanberis Pass.—*R. confervoides* DC. On stones near Llanberis, and on Snowdon.

Arthonia radiata Ach. and var. *Swartziana* Sydow. On oaks near Llanberis Castle; also a brown form on alders near Nant Perris, Mr. G. Travis.

Graphis scripta Ach. Woods near Llanberis Castle.

Phæographis inusta Müll.-Arg. *var. *macularis* A. L. Sm. With the preceding species.

Dermatocarpon aquaticum A. Zahlbr. Stream between Crib Goch and Cwm Glas.

**Verrucaria lævata* Ach. Stones in the stream near Llanberis Castle.

Arthopyrenia epidermidis Mudd. On birch and oak near Llanberis and Nant Perris.—*A. submicans* A. L. Sm. On smooth bark near Llanberis Castle; also found on alders near Nant Perris by Mr. Travis.

Porina carpinea A. Zahlbr. Trees near Llyn Padarn.

SOME ROSES FROM DORSETSHIRE.

By G. A. Boulenger, LL.D., D.Sc., F.R.S.

Whilst spending a fortnight at Studland last summer, I paid special attention to the Roses, represented by a great variety of forms, some of which could not be brought under any of the definitions in the useful compilation prepared by Major Wolley-Dod for this Journal, summarizing all that is known on the distinction of the British species and varieties and their nomenclature. The following notes show how much can be added to our knowledge of this most intricate subject even in localities one would expect to have been well explored.

Rosa ptychophylla, sp. n.

A low, erect, lax bush, 4 feet high, rather scantily foliated, the folioles small (24 to 36 mm. by 12 to 20) and folded, so as to appear extremely narrow, and edged with red, which colour makes the stipules and the prickles very conspicuous; in full bloom in the first half of July, the flowers ($1\frac{1}{2}$ inches in diameter) numerous, projecting beyond the terminal leaves of the branches bearing them, solitary, geminate, or in clusters of three or four, pure white when fully open, feebly scented, the petals in the buds tinged with yellowish pink. Year's shoots stiff, erect, green with bright red prickles.

Disc very convex, styles smooth and more or less projecting, often agglutinated in a very distinct column, with the stigmas forming a conical head. Sepals shorter than the petals, narrowly bipinnate, pubescent, woolly on the edges, with scattered small red glands; calyx-tube glabrous, twice as long as broad; pedicels smooth or with scattered stipitate glands, $1\frac{1}{2}$ to $2\frac{1}{2}$ times as long as the calyx-tube. Bracts large, foliate, very hairy, sometimes reaching the extremity of the corolla.

Folioles 7, small, $1\frac{2}{3}$ to $2\frac{1}{3}$ times as long as broad, ovate to ovate-lanceolate, rounded at the base, acute at the end, sessile or nearly so, uniserrate without glands, the teeth sharp and numerous (15 to 30 on each side), glabrous, dark green and shiny above, pale green and hairy all over beneath, the hairs very long on the mid-rib; petioles with prickles and scattered stipitate glands, glabrous or feebly hairy; stipules rather broad, glabrous.

Prickles on the flowering branches large or moderate, more or less curved, longer than their basal diameter; on the year's shoots large and feebly curved, sometimes very crowded and unequal in size, some perfectly straight with broad base, others reduced to acicles; on old stem numerous, straight or feebly curved, longer (up to twice) than their basal diameter.

Studland, Dorsetshire. Three bushes growing close together on a sandy soil among gorse and brambles, near a *Rosa rubiginosa*.

When I discovered them on July 2nd they were in full bloom, and on the 11th they were only beginning to wane. Branches gathered on the same bushes on Aug. 10th and brought to me by a friend, had the green hips 12 to 16 mm. long by 7 to 10 wide, as long as or a little longer than the pedicels, with convex, reddish-brown discs and the pistils projecting 3 mm.; the sepals folded down; no change in the colour of the foliage. In November, I received ripe hips, with tough, leathery coat, cherry-red (Dauthenay, Répert. de Couleurs, pl. 91, tone 4), 15 to 18 mm. long by 9 to 11 wide, pedicels 18 to 20 mm.; disc dark brown, projecting pistils 2 to 3 mm. long. One which I opened contained 6 well-formed akenes (6 mm. by 4) in addition to as many imperfectly developed.

When I came across these bushes, their appearance struck me as utterly unlike anything I had seen before, I was as much startled as when I first saw *R. rubrifolia* alive, and I have since been unable to identify the species from the descriptions of British and Continental authors or after a diligent search through the herbaria in the British and Paris Museums, at Kew, and in the Rouy herbarium in Paris, to which Prince Roland Bonaparte has kindly given me access.

This Rose falls under the definition of the *Stylosæ* section of the genus, whatever the value of the group may be as a natural association. I have compared it with *R. stylosa*, of which the Déséglise herbarium contains an example, from the Dept. Vienne, sent by Desvaux as absolutely typical. In this example, the folioles, 5 or 7 in number, are also sessile, although Desvaux describes them as petiolulate, and bear 15 to 18 teeth on each side, but they are very hairy above as well as beneath, and more attenuate at the base. Of *R. leucochroa*, I have seen an authentic specimen from Poitiers (Desvaux, April 1813) at Kew; it has broader folioles, pubescent on the ribs only, and the flowers are said to emit a pronounced odour of musk. The type of the var. *microphylla* Rouy, from L'Arboie, Isère, seems to me to represent nothing more than a small-leaved form of *R. stylosa*; folioles pubescent above, not glabrous as stated by Rouy, with 18 to 22 serræ on each side; sepals longer than the petals, which are stated to be pink; pedicels smooth. *R. systyla*, which I have found at Studland, is a high bush similar in habit to the larger forms of *R. canina*, with larger pink flowers, much larger leaves with petiolulate folioles, projecting beyond the flowers, as in the specimens of *R. stylosa* and *R. leucochroa* figured by Desvaux as well as in all our Roses of the *R. canina* and *R. stylosa* groups; my specimens agree well with some in the Déséglise collection (*R. fastigiata* Bast.), also with Christ's description in *Rosen der Schweiz*, as well as with a specimen from the Basle Jura sent by him to Déséglise.

I cannot suggest a hybrid origin for this remarkable form. The only Rose-bush growing quite near was, as I have said above, a *R. rubiginosa*; not far off there were bushes of *R. canina* which seem to fall under the var. *dumalis*, with white flowers and mostly 7-foliolate leaves. Bechstein's *R. dumalis* in the strictest sense has rose flowers and 5-foliolate leaves on the flowering branches. I am well acquainted with it in Belgium (Famenne), where, owing to its more shiny and darker foliage and smaller flowers, I can usually distinguish it at a distance from the typical *R. canina* (*lutetiana*) in hedges where the two grow side by side. White-flowered var. *dumalis* also occur in the same district in Belgium, but are the exception and not the rule as round Studland, where the half-open petals are often yellow at the base. There is no *R. arvensis* in the immediate neighbourhood, although the character of the leaves not extending beyond the flowers—an important character which should certainly be included in the definition of *R. arvensis*, exceptions being very rare—might suggest such a parentage. Crosses between *R. arvensis* and *R. stylosa* have been described, but they are quite unlike *R. ptychophylla*.

As stated by Burnat and Gremli (Roses Alp. Marit. p. 34), "L'hypothèse de l'origine hybride d'une Rose ne doit être admise que rarement et après mûr examen." The present form deserves attention and the only course open to me is to treat it, provisionally, as a distinct species, much as I deplore the excessive splitting-up by which some systematists have increased the difficulties of a most perplexing subject of study.

Rosa arvensis, var. major Coste.

The name var. *umbellata* Godet should be applied to the remarkably robust form often called *R. bibracteata* Bastard in this country, but for the fact that there is an earlier *R. umbellata* (a variety of *R. rubiginosa*); Wolley-Dod has suggested the appropriate name *major* Coste, as Rouy and Foucaud regard *R. bibracteata* as a *R. sempervirens* × *stylosa*, an opinion which is probably correct. Some of the specimens I have seen in British herbaria are probably hybrids *R. arvensis* × *stylosa*.

Several bushes grow on the side of the road from Studland to Corfe Castle; I have found the same form in Surrey, at Clandon.

The bush has much the same trailing habit as the typical *R. arvensis*, but the stems are much stouter, also purple, and the prickles on the flowering branches are large and strongly hooked, instead of small and often straight or nearly so. The folioles are large, dark green and rather shiny above, glabrous, 7, rarely 5 in number, 1½ to 2 times as long as broad, the terminal 21 to 39 mm. by 14 to 24, mostly acutely pointed, with 8 to 15 simple teeth on each side, some of which may bear one or two glands; petioles glandular and prickly, the prickles sometimes extending under the mid-rib of the folioles. Crépin has attached an undue importance to the number of folioles on the middle leaves of the flowering branches in his keys to the sections and species: thus *R. micrantha* has more often 5 than 7 in this country and in Belgium, though not so in Switzerland, and yet is placed in the *Caninæ*, defined as having the middle leaves 7-foliolate, whilst 7 as against 5 is given as a useful character for distinguishing *R. arvensis* from *R. sempervirens*. It is well to state that 5 is the rule in *R. arvensis*, in the South of England at least; in Smith's *English Flora*, ii. p. 397, it is described as with "leaflets 5, rarely 7."

Flowers large, white, up to 50 mm. in diameter, in clusters of 3 to 9, extending beyond the leaves; pedicels smooth to densely glandular (in the same cluster), 3 to 6 times as long as the calyx-tube, which is naked; sepals short, pubescent on the inner side, with stipitate glands on the borders, with one or two short, simple pinnæ. Although I have carefully examined quite a hundred bushes and every specimen in the British Museum (British collection and Déséglise collection) and Kew herbaria, I have not yet come across *R. arvensis* without any pinnæ at all, in spite of the usual definition in books "sepals usually quite entire or very slightly pinnate." In *R. bibracteata* Bastard the flowers are rosy white: a specimen from Anjou, sent under that name by Bastard to Kew, seems to be *R. systyla* pure and simple.

This is not a sharply-defined variety, as I have come across specimens with large leaves and solitary or geminate flowers, and others with small leaves and umbellate or corymbose flowers.

Rosa arvensis × micrantha?

A bush about 3 ft. high, growing in a hedge with *R. arvensis* and *R. micrantha*, should perhaps be regarded as a hybrid between these two species.

In habit similar to *R. arvensis*, but stems without purplish tinge and leaves extending beyond the solitary flowers, which are pure white and measure 40 mm. in diameter. Pedicel thickly beset with stipitate glands, 4 to 5 times as long as the calyx-tube, which is oval and abundantly though less profusely glandular; sepals short, pubescent on the inner side, with stipitate glands on the borders and two pinnæ on each side, these longer than usual in *R. arvensis*. Leaves all 5-foliolate; folioles sessile, eglandular beneath but hairy on the mid-rib, which may bear a few prickles, small, $1\frac{1}{2}$ to 2 times as long as broad, the terminal 20 to 25 mm. by 10 to 14, acuminate at both ends, with 8 to 12 teeth on each side, each usually bearing one or two glands; petioles with glands and prickles. Prickles on flowering branches feebly curved, with narrow base.

I am not aware of such a supposed hybrid having been described before, but Burnat and Gremli (Suppl. Mon. Roses Alpes Marit. p. 82) mention, without giving it a name, a variation of *R. arvensis* with 5-foliolate leaves and glandular calyx-tube, which is perhaps to be regarded in the same light, *R. micrantha* being recorded from the same locality (Cosio). *R. arvensis*, var. *setosa* Bagnall (Midland Natur. v. 1882, p. 181), from Warwickshire, which I have seen at Kew, is perhaps the same hybrid ("arched scrambling bushes, not at all prostrate"). A *R. micrantha* from Plymouth (Briggs, 1867, Herb. Kew), with long smooth pedicels, is probably another hybrid form between these two species.

Wolley-Dod says of the typical *R. arvensis* that the pedicels "always bear sessile or shortly stipitate glands which do not extend to the fruit." I have, however, come across specimens in Surrey with small glands scattered over the whole calyx-tube, as well as others in which the glands are absent, or reduced to a very few, on the pedicel. Christ describes the form *repens* from Switzerland as with the pedicels smooth or beset with sessile glands. In the South of England and in Belgium the glands are usually distinctly stipitate. A *R. arvensis* in the Kew Herbarium, from between Ednaston and Hollington, Derbyshire (Exch. Club Rep. 1887, p. 181), named by Crépin *R. reptans*, has doubly serrated folioles, the smaller serrations with 2 or even 3 glands; the flowers project beyond the leaves.

Rosa canina, var. oblonga.

Rosa oblonga Déségl. & Rip. is mentioned by Wolley-Dod among the foreign "species" which should be looked for in this country. A bush at Studland answers the definition, and I have been able to compare a flowering branch with the specimens in the Déséglise herbarium—a rather mixed lot, I think; there is, however, practical identity with the small-leaved specimen (no. 892) from Marmagne (Cher).

A lax bush, 4 ft. high, with small leaves, some tinged with purplish red, with purplish-red stipules, small, pale rose solitary flowers, and strong, straight or feebly curved prickles. Growing isolated.

Folioles 5 or 7, 1⅔ to 2 times as long as broad, the largest 20 mm. in length, acutely pointed, rounded at the base, petiolulate, glabrous, with stipitate glands on the mid-rib, biserrate (13 to 16 double long and sharp teeth on each side), eglandular on the teeth or only here and there with a stipitate gland, except at the base; petioles with stipitate glands and uncinate prickles. Corolla 35 mm. in diameter; sepals nearly as long as the petals, eglandular, with two long, simple pinnæ; pedicel smooth, not longer than the ovate calyx-tube.

But for the more obscurely gland-tipped secondary serrations of the folioles, this Rose agrees with Baker's definition of the var. *biserrata*, in the synonymy of which his *R. vinacea*—of which I have examined types from near Thirsk, in Herb. Kew—is placed: "Scarcely different from the last [var. *dumalis*] but the serrations open and compound, the petioles more glandular-setose, and the glands extending a little to the midrib beneath. My *vinacea* has oblong fruit, narrow sharp-pointed leaves and bracts, branches and stipules suffused with vinous red." It seems to me midway between *R. vinacea*, with which it is probably connected by specimens such as Mr. Rogers's from Luccombe Chine, alluded to by Major Wolley-Dod, and the small-flowered and small-leaved, but mostly though not invariably uniserrate var. *aciphylla* Lindley (*nec* Rau) which should probably bear the name *exilis* Crépin (1868) into which it grades; I have observed Crépin's var. *aciphylla* growing in Belgium (Han-sur-Lesse and Wavreille).

The three allied varieties, as here understood, may be thus contrasted:—

Serrature compound, with abundant glands; petioles and sepals glandular .... var. *vinacea*.
Serrature double, without or with very few glands; petioles glandular; sepals eglandular .... var. *oblonga*.
Serrature simple or irregularly double, without or with very few glands; petioles eglandular or with very few glands; sepals eglandular .... var. *exilis*.

The third variety leads to the typical *R. canina* (*lutetiana*) in which the leaves are larger and quite eglandular.

Rosa micrantha, var. Lusseri.

Rosa Lusseri Lagger and Puget, 1873, was described from Bovernier in Valais, Switzerland; it was placed in the synonymy of *R. permixta* Déségl. by Déséglise, in whose herbarium an authentic specimen from Bovernier, sent by Lagger, is preserved; the leaves are much less hairy than in others, likewise from Bovernier (Lagger), at Kew, which explains how Crépin (1882), who had also seen authentic specimens, thought it suggestive of certain varieties of *R. tomentosa*. In my opinion it must be regarded as a variety of *R. micrantha* Smith (*permixta* Déségl.), approaching the var. *Briggsii* Baker, of which I have examined the types at Kew; but its glandular pedicels preclude identification with the latter. Christ's var. *salvifolia*, from the Western Alps of Switzerland, is probably a mere modification of this variety, and Coste's var. *macrophylla*, from the Charente-Inférieure and the Ain, may be the same; Rouy and Foucaud's key leads to it.

The following description is taken from a bush observed on the road from Studland to Corfe Castle:—

A robust, tall bush, about 6 ft. high, with flexuous branches. Flowers 2–3; corolla bright pink, as in *R. rubiginosa*, 40 mm. in diameter; disc convex, styles smooth; sepals nearly as long as the petals, with 2 or 3 long, simple or barbed pinnæ bearing stipitate glands on the back and on the margin; calyx-tube elongate, contracted at the neck, $1\frac{1}{2}$ to $1\frac{2}{3}$ times as long as broad, with stipitate glands at least at the base; pedicel longer than the calyx-tube, densely stipitate-glandular. Leaves large, up to 85 mm. long, bright green, paler and duller beneath; young leaves tinged with red; folioles 5, $1\frac{1}{3}$ to $1\frac{2}{3}$ times as long as broad, the largest 42 mm. long, perfectly rounded or more or less acuminate at the end, more or less narrowed at the base, sometimes truly obovate, petiolulate, with scattered hairs on both sides, densely tomentose on the ribs, with small sessile glands on the lower surface; serrature deep, open, compound, with numerous glands, feeble or obsolete at the base; the larger folioles with 12 to 18 principal teeth on each side; petioles tomentose-glandular, with numerous acicles and rather strong, curved prickles. Prickles on flowering branches uniform, strong and hooked.

One of the best characters for distinguishing *R. micrantha* from *R. rubiginosa* appears to me to be the more convex disc in the former, beyond which the smooth styles project considerably after the fall of the stamens, sometimes answering to the definition of *R. stylosa*.

THE HOME OF INULA HELENIUM.

By C. C. Lacaita, M.A., F.L.S.

Elecampane has been cultivated for the properties of its root from time immemorial in sundry parts of Europe. This has led to its establishment here and there as a naturalised alien in many regions where it has no claim to be indigenous; such, for instance, are Great

Britain, the Low Countries, northern France and Germany, and Scandinavia. In the *Species Plantarum* Linnæus only mentions England and Belgium as the habitat of *Inula Helenium.*

This history has led Beck von Mannagetta in his "Inulæ Europeæ" (in Denkschr. Ak. Wien, xliv. (1881)) to maintain that *Inula Helenium* is a native of middle Asia, and in Europe only subspontaneous as an introduced alien; an opinion re-asserted by him in his *Flora von Nieder Oesterreich* (1893), 1179, and accepted in some more recent works. The species is no doubt spontaneous in western Asia, but a reference to Boissier's *Flora Orientalis* is alone sufficient to refute Beck's statement as to Europe, except so far as the northern and western parts of the continent are concerned. In Fl. Or. iii. 186, in addition to the Asiatic distribution then known, there are quoted localities in Greece and Macedonia where it is inconceivable that this species can be other than a genuine wild indigenous plant. Such are the middle region of Mount Kyllene in the Peloponnesus, the foot of Mount Olympus, and the high pastures of Scardus.

In southern Italy, too, the plant is unquestionably indigenous.

Trotter and Romano, who explored the valley of the Cervaro—this valley is traversed by the old high-road, and now by the railway from Naples to Apulia, and under the name of Val di Bovino was notorious in the old days for brigandage and highway robbery—some twenty-five miles S.W. of Foggia, on several occasions between 1910 and 1912, say (Nuov. Giorn. Bot. Ital. n. s. xxi. 402) that along the river Cervaro and above it, in the short lateral valleys beneath the wood "Macchione," there are found the most conspicuous associations of *Inula Helenium* they know. In a level pasture near the river the *Inula* forms a company of many hundred individuals, which in July were opening their splendid heads of flower, giving to the spot an unusual look of spring-like gaiety. The authors add, "Beck's hypothesis that this *Inula* is to be considered a naturalised plant in Europe therefore does not seem to us to be well-founded." Plate ix. fig. 2 in the same publication shows one of the authors standing up to his shoulders in this immense field of Elecampane.

I have myself collected *Inula Helenium* in one of the wildest regions of the southern Apennines, in clayey mountain-pastures between Teggiano and Sacco, miles from any cultivation present or past; on the other hand, it is not recorded from southern Italy anywhere in the neighbourhood of gardens from which it might have escaped. In Spain, too, according to Willkomm & Lange (Prodr. Fl. Hisp. ii. 46) it is found "in pratis et graminosis, ad fossas regionis montanae Hispaniæ borealis, central. et oriental. passim." This is not the behaviour of an introduced alien.

SHORT NOTES.

Erythræa scilloides Chaubard. In the 1918 Report of the Botanical Exchange Club (p. 290, "July," 1919) Dr. Druce treats Mr. Arnett's Pembrokeshire plant as a variety of the Azores species and names it *portensis*, which is the name of the Portuguese form. He says that Malinvaud "held the plants to be distinct species," and that Le Jolis "also considered it to be a distinct species." Dr. Druce evidently has not read Le Jolis' paper of 1896—for references see my article in Journ. Bot. 1918, 321—where that author goes very fully into the matter and regards the two as identical; nor did he in any of his previous works express the opinion implied in Dr. Druce's remarks. Dr. Druce's observations about "Malinvaud" are also erroneous: I omitted to refer to him because he was only writing a notice, in which he gives no opinion of his own, of Le Jolis' paper: moreover, the remark quoted as from Malinvaud does not exist. I note that Dr. Druce makes no reference to my article; when his attention was called to this at the meeting of the Linnean Society on Nov. 6, he explained that the B. E. C. Report—which, although dated "July 1919" did not reach the members of the Club until late in October—was already in type when my paper appeared in November, 1918; certain coincidences of expression must therefore be regarded as accidental. The only tangible difference between the Azorean and the European plant seems to be that the former is "always white-flowered." When investigating the matter I started by supposing that the plants might be different not only in the Azores but in Portugal and North France. In the Azores the species is stated to be extremely variable, and Le Jolis says the same of the French plant. My examination showed that the habit of the species in the Azores sometimes more resembles that of an ordinary *Erythræa* than it does in Europe, but I could find no way of separating them. I have a distinct impression that I have read somewhere a statement by one who had gathered the plant in the Azores that the flowers were as often pink as white, but at present I cannot find it. Since the history of the Linnean name is unsatisfactory, it may be well, at any rate for the present, to call the British plant *E. portensis* Brot.—A. J. Wilmott.

On Collecting Roses. I should like to impress upon collectors of Roses the extreme importance of collecting well-developed fruit—not necessarily fully ripe which has become pulpy, but that which has fully reddened, though if the sepals have already fallen it is not necessary to wait for the reddening stage provided the fruit is fully grown. I would rather have a specimen to name gathered in late October, or even November, than in June. I have just been looking through a collection of about sixteen specimens from Ireland by Mr. Stelfox, in which he at first sent me flowering specimens, or young fruit, promising me ripe fruit later. I named these provisionally and kept them by me till the fruiting specimens arrived; these showed that I was wrong in my provisional names in three cases, and I was able to give names to three others I had given up in the flowering stage. In fact, I could have named every one from the fruiting pieces alone; but I must add that my diagnoses were greatly helped by the generous supply of material Mr. Stelfox sent me, and I have greater confidence in the majority of the names I have given him than in those for any collection I have yet seen. The genus *Rosa* as represented in Britain unquestionably constitutes our most difficult one. On this subject I will not now spread myself, but much of the doubt I often have to express on specimens is due to collectors sending me the ends of flowering shoots, which are almost useless. The colour of the petals is of small value, and both prickles and leaflets are often abnormal in shape on the ends of the flowering shoots; while the direction and persistence of the sepals on the ripe fruit, as well as the shape of the latter, is quite lost in flowering specimens. Pieces of barren shoots also are often abnormal, the best specimens being those cut from the wood of the previous year with two or three flowering branches attached. More than one specimen from each bush also facilitates diagnosis.—A. H. Wolley-Dod.

Salsola caffra Sparrman. This name, which is published in Sparrman's *Voyage to the Cape of Good Hope* (1785) does not seem to have been taken up by subsequent authors. It is evidently synonymous with *S. aphylla* L. f. (Suppl. 173: 1781), but it may be worth while to extract the passage relating to it: "There is another shrub frequently found in the Carrow, which grows here [Lange-dal] likewise, and is called *Canna-bosch*; whence the whole tract of country hereabouts bears the name of *Canna's*, and not *Canaan's Land*, as Mr. Mason [Masson] has called it in the *Philosophical Transactions* [lxvi. 287] . . . A road between Artaquas and Lange-kloof . . . is called *Canna's hoogte* or Canna's heights. Having examined this same Canna-shrub, I found that, in strict propriety, it formed a new species of *Salsola*; for which reason, in my manuscript descriptions of plants, I have called it *Salsola caffra, foliis minutis subrotundis, carnosis, concavis, imbricatis.* The leaves have a bitter salt taste, and burned together with the whole shrub produce very strong ashes, excellently well adapted for the purpose of making soap; for which reason, particular attention is paid by the Carrow farmers to the culture of this plant. In the parts of the flower, the *Canna*-shrub so far differs from the generical character of the *Salsola* in the sixth edition of the *Genera Plantarum*, inasmuch as this species has a little obsolete *style*, with two or three brown *stigmas*. The remaining parts of its character were, *Stam. fil. breviss. Antheræ cordatæ, Calyx perianth. persistens, Capsula 5 valvis, 1 locularis*, and *semen* 1 *cochleatum*, as in the *Salsola*, or rather resembling a watch-spring coiled up" (i. 297: I quote from the second edition (1786), but believe this does not differ from the first). In *Flora Capensis*, v. 1. 453, the vernacular name is given as "Brak Ganna."—James Britten.

Cystopteris montana in Banffshire. In the *Life of a Scotch Naturalist, Thomas Edward*, by Samuel Smiles, ed. 3 (1877), it is recorded that from time to time Edward sent occasional natural History notes to the local *Banffshire Journal*: in one of them he reported that this beautiful Fern had been "found on Benrinnes by a gentleman from England and sent to me as a rarity" (p. 212). I cannot find any note of the occurrence of this species in Banffshire in Dickie's *Guide* (1860), Top. Bot., Craib's *Banffshire Flora* (1911), or elsewhere. This mountain, the most northerly outlier of the Grampian Chain, which rises to 2755 feet, seems a very likely spot for the plant, and one hopes the discovery may be confirmed.—C. E. Salmon.

Poa omeiensis, comb. nov. Mr. C. V. Piper has kindly drawn my attention to the preoccupation of the name *gracillima*, under which I described a *Poa* from Mt. Omei, Szechuen, in Journ. Linn. Soc. (Bot.) xxxvi. 424 (1904). I regret to have overlooked the previously described *Poa gracillima* Vasey (Contrib. U.S. National Herbar. i. 272, 1893). The Chinese species may take the name *Poa omeiensis*.—A. B. Rendle.

H. W. Burgess (Journ. Bot. 1918, 223). Burgess's "official position" is explained by the fact that in 1833—and probably some years earlier—he was Landscape Painter in ordinary to William IV. He exhibited at the Royal Academy from 1809 to 1844, and most of his exhibits were of trees and landscapes—in 1812 and 1813 he exhibited pictures of ilex and cedar trees. The art of painting was practised by several successive generations of the Burgess family for about a century and a half: William Burgess, father of Henry William, was an exhibitor at the Royal Academy 1774 to 1811.—W. Roberts.

Euphrasia hirtella Jord. Too late for an additional paragraph to my paper in the December number (p. 336), I have received from Mr. Pugsley robust specimens of *E. hirtella* collected last August by Miss Armitage near Llanberis. These are barely distinguishable from specimens I gathered at the head of the Roseg Valley, Engadine (6500 ft.), July 1900, which the late Mr. Townsend had determined as *E. minima*, but which to me seem good *hirtella*. The Swiss specimens are 11–15 cms. high, considerably taller than any *E. minima* I remember seeing. They are naturally less mature than the later specimens from Llanberis gathered at a much lower elevation; and notwithstanding the lower internodes being longer than in the Welsh specimens, a feature which Mr. Pugsley says is not constant and was omitted from Wettstein's diagnosis, I believe both gatherings to be *hirtella*.—H. S. Thompson.

Satureja montana L., in Hants. In 1912, I first gathered this South-European plant in the station in which *Hyssopus officinalis* L. has been known for centuries to occur, viz., the crevices in and summits of ruined walls at Beaulieu Abbey, New Forest, Hants. It seems more abundant than the Hyssop, and is mostly difficult to obtain, growing some distance out of reach. Being a perennial, its stems become thick and almost gnarled, and it is not surprising that it has been, till now, considered an attenuate variety of *Hyssopus*. As such I sent specimens to the Botanical Exchange Club some years ago, but I was never satisfied with this determination, and worked it down to *S. montana* L.; Mr. E. G. Baker has confirmed my view, as well as Mr. G. C. Druce, to whom I also sent specimens. The latter informs me that Miss C. E. Palmer gathered it in this same locality in 1900, naming it *Hyssopus*, and he likewise found it there in 1908, but omitted to record it. It has, however, been noted (*vide* B. E. Club Report, 1908, ii. 350) for "Sussex, as an alien," exact locality unknown to me. This is the first time it has been actually recorded for Hants, although doubtless it has been there, with *Dianthus plumarius* L. and *Hyssopus officinalis* L. ever since the days of the monks, this Abbey being dissolved in 1539, temp. Henry VIII. As both the aforementioned have long been admitted to our Floras, the insertion of *Satureja montana* should follow on the same grounds.—J. COSMO MELVILL.

REVIEWS.

Le Mythe des Symbiotes. Par AUGUSTE LUMIÈRE. Pp. xi+205. 6 fr. 8vo. Masson, Paris, 1919.

THE tendency of modern bacteriologists has been to glorify their own objects of research at the expense of higher organism, even to the extent of imagining all protoplasm to be essentially bacterial in composition, or, again, that the plasma of higher animals exists in a state of *symbiosis* with bacteria in all the tissue-units: they suggest, for example, that no tissue is aseptic, that mitochondria are really bacterial in nature, and that such substances as *vitamines* are the product of symbiotic bacterial action (Portier, 1917).

It is easier to start such hypotheses than either to prove or disprove them, and in the present volume M. Lumière proceeds to demolish the views put forward by Portier. Cultures of bacteria from tissues of the frog and guinea-pig show that such germs exist only as saprophytic or parasitic forms, more or less in a resting-stage, in the internal organs. Injections of bacterial cultures in the vegetative condition are rapidly cleared from the blood and tissues. Isolated resting-stages on culture prove to be common innocuous forms with no special attributes. The relation of the host and parasite is not so much a symbiosis as a fight in which the higher organism, as such a term would imply, is quite competent to look after itself.

The work is of interest to botanists, since conceptions of a very similar state of symbiosis in plant-forms, as in the case of root-tubercles and endotrophic mycorhiza, are apt to be somewhat overdone. In all such relations among higher plants the "symbiosis" is of very restricted nature, only helpful to the host when ending in the death and digestion of the intruder. In other respects the idea of bacterial plasma existing within the cytoplasm of the host has much in common with older and exploded theories of the mycoplasm of parasitic fungi. A very useful list of literature is appended.

A. H. C.

Elementary Notes on Structural Botany. Oxford Botanical Memoirs, No. 4. By A. H. CHURCH, M.A. Pp. 1–27. Price 2*s.* net. Oxford University Press, 1919.

THIS short "memoir" is a series of schedules intended to cover a course of twelve lectures with accompanying practical work of twelve periods of two hours each. The general treatment follows closely the conventional lines, and the suggested objects for practical study are mostly those in common use. In reference to the latter, however, we note that the specialized laminæ of *Ficus elastica*, *Nymphæa*, and *Lavendula* are employed, whilst in the microchemical reactions the use of 25 °/₀ H_2SO_4 with phlorogluein is advocated in place of hydrochloric acid.

Starting with the conception of the cell, the author deals in succession with the growth of the shoot, the leaf, Photosynthesis, Transpiration, Stem-structure, Root-structure, the Transpiration-stream, and perennating organs. The anatomical details are interspersed throughout with occasional notes regarding the physiological functions, a feature which could with advantage have been carried further. The outcome is a series of lessons which follow a logical sequence in a connected whole. The advocacy of micrometer measurements by elementary students is a suggestion that might well be adopted as calculated to inculcate greater accuracy of observation.

The only serious omission we have noted is that of light as a controlling factor in the stomatal mechanism. It is also to be regretted that the word proteid is used throughout in place of the more modern protein.

Whether the practical work involved could be adequately compassed in the time allotted we have considerable doubts, but teachers in general will find the scheme useful if only for comparison with that which they themselves adopt.

E. J. S.

Flora of the Presidency of Madras. By J. S. Gamble. Part III. (pp. 391–575). 10*s.* net. Adlard & Son.

THIS part deals with the Flora from the *Leguminosæ Cæsalpinioideæ* to *Caprifoliaceæ.* We have tested various genera and find the work carefully done, though we are not always in agreement with the author in his conclusions. He supplants *Poinciana* L. by *Delonix* Rafinesque (Fl. Tellur. ii. 92 (1836)). Linnæus (Syst. ed. i. 1735) took *Poinciana* from Tournefort who founded it on the plant now referred to *Cæsalpinia* as *C. pulcherrima* Sw.: Linnæus (Cent. ii. 16 (1756); Amœn. iv. 313 (1759)) added *P. elata.* Bentham and Hooker, Dalla Torre, and Harms retain *Poinciana* for three African and Asiatic species; we should be inclined to follow this course, and to start the genus from the *Centuria* or the *Amœnitates* rather than suppress it altogether.

The genus *Acacia* is of peculiar difficulty, especially as to the discrimination and limitation of the species allied to *A. Catechu* Willd. In his clavis Mr. Gamble states the spines are hooked and short in *A. Suma* Buch. Ham., *A. Catechu*, and *A. Sundra* DC., and that in the first two of these the petals are white and villous. But Kurz in his *Forest Flora* (i. 422) says that the spines of *A. Suma* are usually straight and makes *A. Sundra* DC. a variety of *A. Catechu*, and that the calyx and petals of *A. Catechu* proper are more or less appressed and pubescent. Much confusion has occurred with these plants, as the *A. Catechu* of Bentham (in Hook. Lond. Journ. i. 510) and of Beddome (Fl. Sylvat. t. 49) is *A. Suma*; the *A. Catechu* of the *Flora of Tropical Africa* (ii. 344) is referred by Harms to *A. Suma* and by some authorities to *A. campylacantha* Hochst.; the true *A. Catechu* is figured by Roxburgh in his *Coromandel Plants*, t. 175. The spikes of *A. Suma* are tomentose, the young leaves greyish pubescent, and the bark white or greyish white; in *A. Catechu* (including *A. Sundra* DC.) the spikes are glabrous or pubescent, the leaves glabrous or nearly so, and the bark dark brown.

We find some difficulty in using the author's measurements, which are in inches and decimal parts of an inch; thus the leaflets of *Acacia Roxburghii* are ·1–·125 inches by ·025 inches and the leaflets of *A. Campbellii* are ·075 by ·025 inches.

The work when completed will be a most useful guide to the Flora of Madras—one of its important features being its light weight and portability.

E. G. B.

Science and Fruit Growing: Being an Account of the Results obtained at the Woburn Experimental Fruit Farm since its foundation in 1894. By the Duke of Bedford, K.G., F.R.S., and Spencer Pickering, M.A., F.R.S. Macmillan & Co., pp. xxii, 351, 1919. Price 12*s.* 6*d.* net.

If the first word of its title does not frighten them away from it, this book should have a most useful educative result upon the so-called practical man. As the authors remark (p. 109):—"Perhaps the oft-repeated, and more often mistaken cry of the antagonism between theory and practice, is the reason why growers are so prejudiced against experiments, mistaking experiment for theory, and the blind observance of traditions for practice."

The obviously practical conclusions reached—as, for instance, in the desirability of reducing the pruning of fruit-trees to a minimum and the uselessness of manure for these trees—should demonstrate the value of the experiments; and the whole book forms an invaluable lesson in the art of scientific experiment and in the logical induction of results. It was fitting that, after twenty-five years' work and on the eve of the transference of a private enterprise to Government control, a general account should be published of the varied experiments hitherto only made known in sixteen special reports; and this is well given in the present volume. It is prefaced by an admirable chapter giving a summary of the structure and physiology of the higher plants and some necessary general explanations of the nature of fungi and insects. Room might, perhaps, have been found for some reference to heterœcism among parasitic fungi; but it would be difficult to suggest any improvement in the accounts of the specific fungi, the silver-leaf and the potato-disease, and the particular insect-pests to which special chapters are devoted.

A detailed discussion of various fungicides and insecticides leads to a serious arraignment of the Food Production Department for their wholesale advocacy of a single spraying solution and that a faultily-composed one; but the investigations of greatest scientific interest are, perhaps, those discussed in chapters xxv–xxix, as to the sterilizing effects of heat and of anæsthetics on soils, the production of chemical changes independent of their bacterial contents, the difference in the soil conditions desirable for germination and for subsequent growth, and the demonstration (by a process of exhaustion in which aëration, bacteria, alkalinity, water-supply, and general impoverishment are in turn dismissed as insufficient explanations) that plants produce toxic substances in the soil which are for a short time detrimental to the growth of others.

The book contains excellent portraits of its authors and well-chosen photographic plates and illustrations in the text.

G. S. Boulger.

Botany for Agricultural Students. By John N. Martin, Professor of Botany at the Iowa State College of Agriculture. New York: John Wiley & Sons. London: Chapman & Hall, 1919, pp. x, 585. Price 12*s.* 6*d.* net.

We are told in the Preface that "this book is intended for elementary courses in Botany in colleges and universities," that its "aim has been to present the fundamental principles," and that it is intended for one year's work, accompanied by laboratory work. The first half of the work is devoted to the anatomy and physiology of Spermatophytes, in which, to suit the time of year at which the Iowa course begins, flowers, seeds, and fruits are dealt with before histology and the vegetative organs. Special sections are devoted to seed-analysis, the testing of germinative capacity, the soil as the home of roots, pruning, grafting, etc. The second half deals with "Plants as to kinds, relationships, evolution and heredity," which means a tolerably full account of algæ, myxomycetes, bacteria, fungi, bryophytes, pteridophytes, and gymnosperms, and a very brief description of twenty-seven families of angiosperms, followed by a chapter on ecology and three others giving an excellent if not very critical sketch, in some fifty pages, of the conclusions of Lamarck, Darwin, De Vries, Weismann, and Mendel as to evolution, mutations, heredity, and plant-breeding.

Students intending to devote themselves to agriculture are hardly likely to be interested in so detailed an account of algæ, or bryophytes, horsetails or club-mosses; and, except under a system savouring overmuch of "cram," we should have thought the book sufficient as a manual for three years rather than one-year's study. Certainly until students have acquired considerable first-hand knowledge of plants they cannot well be in a position to appreciate at their true value the wide-reaching conclusions dealt with in the last three chapters.

If American text-book writers wish their books to be adopted for English use, they must add the scientific names to such popular ones as "Wandering Jew," "Beggar Tick," or "Horse Nettle." The second of these names belongs to *Bidens*, the third to *Solanum carolinense*: "Jimson weed" may be well known to be *Datura*

Stramonium; but "Woodbine" will not suggest an *Ampelopsis* to English students; and what is the "Wandering Jew"?

The book is well printed and illustrated with text-figures which have necessitated the use of a heavily-clayed paper, so that the volume weighs nearly three pounds avoirdupois!

G. S. Boulger.

BOOK-NOTES, NEWS, etc.

The Annual Report of the Cambridge Botanic Garden pays a high tribute to the work of Mr. R. Irwin Lynch as Curator—a post which he has occupied since 1879 and from which he retired last May on the ground of ill-health. It contains notes on the plants of special interest that have been received or have flowered during the year: under the former heading we note that *Stratiotes aloides* "has again been introduced into Coe Fen. from Norfolk; for many years it grew on Coe Fen by introduction from the Roslyn Pit, Ely, where the plant now appears to be extinct." We regret that Cambridge should continue to countenance a practice which one would have hoped was confined to one or two irresponsible individuals—we say "continue," because similar action was taken with regard to *Lathræa clandestina*, which was planted from the Botanical Gardens in a wild-looking spot, and misled an observer to think he had discovered a new British plant (see Journ. Bot. 1908, 123; 1910, 79). Further experiments on plant breeding have been carried out by Miss Saunders on *Matthiola incana*: "A complete series of intermediates has been obtained between the hoary type and the glabrous (Wallflower-leaved) varieties of *Matthiola*, and the inter-relationships of these forms have been established. A distinguishing feature of all the intermediate grades has been found to be the *gradual* assumption of the characteristic appearance in the course of development in contrast to the constant and uniform appearance exhibited *at all stages* by the extreme forms. Hence for the identification of the intermediates it is necessary to examine the plants at intervals, whereas the type is recognisable as soon as the plumule is visible."

Frederick Raine, who was born at Durham, 16 Sept., 1851, died at Hyères, 24 April, 1919, after a long illness. He went south about thirty years ago, on account of ill-health. He had a fine herbarium of French and other flowering-plants, which he bequeathed to the Natural History Museum, Newcastle-upon-Tyne. Raine took great pains in the selection and drying of his botanical specimens, which are remarkably good; the orchids in particular are a very fine and well-preserved set—he spent much time in their study and was keenly interested in hybrids. Albert and Jahandiez named a new hybrid *Ophrys Rainii*—(*O. arachnites* × *bombyliflora*)—in his honour. A reserved but kindly man, he was ever willing to help English and American visitors to Hyères with information about local plants and other matters. He could rarely be persuaded to publish any notes, but many of his plant-records appear in the work on the flora of the Department of the Var published in 1908 by Albert and Jahandiez, as well as in the charming volume on *Les Iles* *d'Hyères* (Paris, 1914), which the brothers Jahandiez compiled, illustrated, and printed in their house at Carqueiranne.—H. S. T.

Dr. James Small has reprinted in pamphlet form from the *Pharmaceutical Journal* (17 Bloomsbury Square, W.C., 1s. net) an interesting and very comprehensive essay on *The Application of Botany to the Utilisation of Medicinal Plants.* The aim of the author "is in the first place to demonstrate the value of botany to the pharmacist, and in the second place to interest the present generation of students in the many interesting problems which, although they have a direct bearing on the exploitation of the plant as a healer, are also purely botanical in the methods required for their solution and in many of the results of such solution. In fact, [the paper is] an attempt to revive the Theophrastian point of view which considers the medicinal plant primarily as a *plant* and only secondarily as *medicinal*, in contradistinction to the Dioscoridean point of view, which considers the medicinal plant only as a drug, very little notice being taken of the life and affinities of the drug-yielding organism. In order to make any considerable progress we must learn from the past, by a rational study of the history of medicinal plants, what methods may be used, what results may be expected, and what dangers may be avoided. A rapid review of the subject from palæolithic times to the beginning of last century will, therefore, be put forward, not in an attempt to summarise the history of such a period, but to elucidate and illustrate the chief lessons it has to teach us." The type—that used in the *Journal*—is unpleasantly small, and one wonders whether it would not have paid to have produced the essay in book-form in larger type, to which its merits seem to entitle it.

The Kew *Bulletin* (no. 9) contains an exhaustive paper by Mr. Lacaita on the history and name of the "Jerusalem Artichoke" (*Helianthus tuberosus*), in which the introduction of the plant into Europe is traced; the tubers first reached England in 1617. The section on the name is at least as interesting as that on the plant: the former dates from 1622, when it appeared in the second edition of Venner's *Via recta.* The popular explanation, originated by J. E. Smith in 1807, that "Jerusalem" is a corruption of the Italian *girasole*, is conclusively set aside: "there has never existed such an Italian combination as the *girasole articiocco* assumed by Smith as the origin of our Jerusalem artichoke," nor does Mr. Lacaita's tentative suggestion seem conclusive. In the same number is an equally important and exhaustive essay by Sir David Prain and Mr. Burkill on "Dioscorea sativa," which contains much matter of bibliographical as well as of botanical value. Biographies of the late William Gilson Farlow, the eminent American mycologist (1844–1919), and J. W. H. Trail (with bibliography) are included in the number, which contains more than seventy pages and, happy in the possession of a well-bestowed Government subsidy, is published at fivepence!

At the meeting of the Linnean Society on Nov. 20 last, Dr. G. C. Druce exhibited specimens of, and made remarks on, what were announced as "Two New British Plants." Of one, *Erythræa scilloides* Chaub., a full account was given in this Journal for 1918, pp. 321–3, by Mr. Wilmott, to whom specimens were sent by Mr. J. E. Arnett, from North Pembrokeshire, on its discovery: a further note will be found on p. 23 of this number. The other, *Ajuga genevensis*, was discovered by Miss Fry on the Berkshire downs in May, 1918, where it is limited to a small area but appears undoubtedly native.

At the same meeting Prof. R. C. McLean made a communication entitled "Sex and Soma." The author enlarged upon the recently-discovered phase of multinucleosis in the developing soma cell of higher plants. The genetic interest of the phenomenon has not received sufficient consideration, and the present paper was designed to direct attention to the possibilities involved. The author maintained, in opposition to Arber and Beer, that there is evidence of nuclear reunions taking place in the multinuclear cells, and he characterized these fusions as modified sexual conjugates consequent upon the long series of vegetable divisions in the lineage of a soma cell, and necessary to avoid the degeneration which experiment shows to be attendant upon prolonged vegetative propagation. The development of the plant body may thus be regarded as embracing two phases of stimulus: firstly, the normal sex stimulus which initiates the period of maximum cell proliferation, and, secondly, this somatic nuclear union, initiating the period of maximum differentiation. Tissue differentiation, it was suggested, may be associated with some process of segregation subsequent to this nuclear fusion. The separation of sex characters in the development of monœcious organisms was pointed to as evidence of the existence of such segregation during development. It was finally suggested that germinal modifications as well as somatic segregations may be derived from a mechanism of nuclear fractionization and subsequent partial reunion in somatic cells.

The post of Sherardian Professor of Botany at Oxford, vacant by the retirement of Dr. S. H. Vines, has been filled by the appointment of Dr. Frederick William Keeble, F.R.S., of whose botanical career some account was given in the *Times* of December 20. Dr. Keeble has edited the *Gardeners' Chronicle* since 1908, and has contributed reviews to our own pages.

The Report for 1918 of the Botanical Exchange Club includes what is evidently a useful monograph of the British Batrachia, by Mr. W. H. Pearsall, and a supplement to the *Flora of Berkshire* compiled by its author, Dr. G. C. Druce.

The *Journal of the Royal Horticultural Society* (xlv. pt. 1: October) contains an account by Dr. Daydon Jackson of Pritzel's *Index* and of the forthcoming new edition, which was referred to last year in this Journal (p. 104).

The Rev. W. Wilks has retired from the secretaryship of the Royal Horticultural Society—a position which he has occupied with conspicuous success since 1888. He is succeeded by Mr. W. R. Dykes, whose fine work on *The Genus Iris* was noticed in this Journal for 1913, p. 103.

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LATE SENIOR ASSISTANT, DEPARTMENT OF BOTANY, BRITISH MUSEUM.

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No. 686 FEBRUARY, 1920 Vol. LVIII

THE JOURNAL OF BOTANY

BRITISH AND FOREIGN

EDITED BY

JAMES BRITTEN, K.C.S.G., F.L.S.

LATE SENIOR ASSISTANT, DEPARTMENT OF BOTANY, BRITISH MUSEUM.

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Bibliographical matters have also received and continue to receive considerable attention, and the history of many obscure publications has been elucidated. Every number contains reviews of new and important books written by competent critics: in this as in every other respect a strictly independent attitude has been maintained. While in no way officially connected with the Department of Botany of the British Museum, the Journal has from the first been controlled by those whose acquaintance with the National Herbarium has enabled them to utilize its pages for recording facts of interest and importance regarding the priceless botanical collections which the Museum contains.

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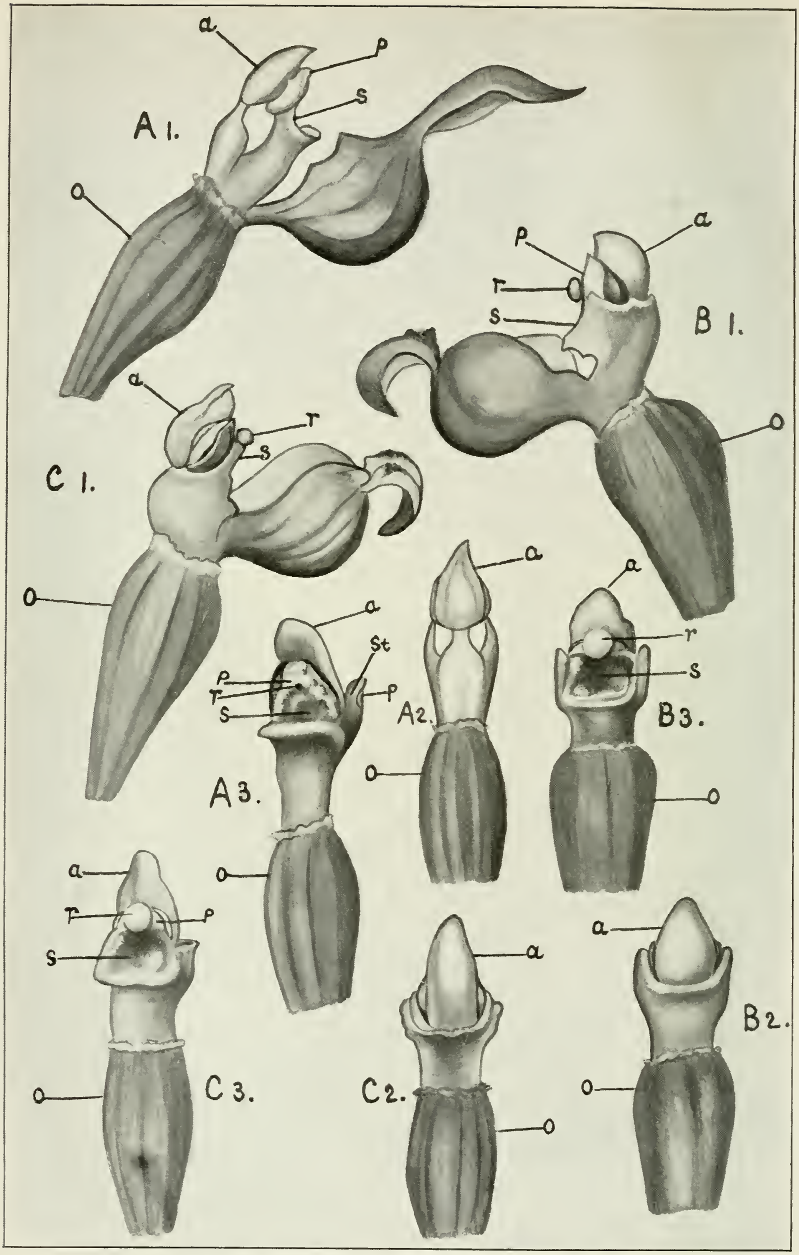
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A. *EPIPACTIS VIRIDIFLORA* var. *LEPTOCHILA* Godfery.
B. *E. LATIFOLIA* All. C. *E. VIOLACEA* Dur. Duq.

1. Side view of column, lip, and ovary. 2. Back view. 3. Front view.

a, anther ; *p*, pollinia ; *r*, rostellum ; *s*, stigma ; *st*, staminode ; *o*, ovary.

EPIPACTIS VIRIDIFLORA Reich.

By Colonel M. J. Godfery, F.L.S.

(Plate 553.)

In the *Journal of Botany* for 1919 (pp. 37–42) I described and named the var. *leptochila* of *E. viridiflora* Rchb., contrasting it with *E. violacea* Dur. Duq. Owing to the necessary drawings not being completed, I could not then go into the question of its specific distinctness from *E. latifolia* All., of which most Continental authors regard it as a mere form or variety. I now repair this omission.

Differences in the Vegetative Organs.

The *root-system* in *E. latifolia* consists of a bunch of fleshy cylindrical processes springing from the base of the stem and forming a dense tassel round it. Last August I found *E. latifolia* with seven stems growing in a tuft from one root-crown, a habit which appears to be rare. Here then, if anywhere, was an opportunity to see a fully developed rhizome. The number of roots was very great—they radiated in a circle in every direction, packed tight together, forming a raised mass or crown, from which arose seven flowering stems, and eight new buds. On turning the root upside down, it was seen to be dome-shaped in its original position. The roof of this dome consisted entirely of brownish-white cylindrical roots tightly pressed together. There was no central rhizome or descending root; I then cut a vertical section through the thick root-crown, with a view to discovering the expected internal rhizome. The section showed that the mass consisted almost entirely of rootlets, the white circular sections of which occupied most of the space in the cut surface. In the neighbourhood of the new buds there were irregularly triangular sections of what appeared to be small separate solid bodies. There was no common rhizome.

In *E. viridiflora* there is a long descending rhizome from which fleshy roots spring at the nodes at different levels throughout its length. At the base, above the roots, there is a thick common rhizome from which the stems arise. The plant is deep down in the soil and difficult to dig up, whilst *latifolia* is easily unearthed.

In *viridiflora* each bud has only one rootlet, springing from its base, on the outside, whilst in *latifolia* there are two, one on each side, in the angle between the bud and the stem.

The leaves in both plants vary in different specimens, and no clear line of demarcation can be drawn. They are, however, differently arranged. In *viridiflora* they are nearly distichous, except sometimes the uppermost bract-like leaves. In *latifolia* the three lowest leaves spring from the stem at approximately an angle of 60° from each other, forming a kind of false rosette (but of course at different levels from each other) round the base of the stem.

The sepals and petals are entirely green in *viridiflora* (very rarely so in *latifolia*) and are longer, more acute, and much more acuminate than in the latter. The epichile is long, narrow, and acuminate, not broad and recurved as in *latifolia*.

DIFFERENCES IN THE REPRODUCTIVE ORGANS.

Plate 553 shows more clearly than a detailed description the differences between the two species. In figs. A 1 (*E. viridiflora*) and B 1 (*E. latifolia*) the following points should be noted:—In A 1 the ovary is spindle-shaped, broadest about the middle, tapering gradually towards each end. In B 1 it is pear-shaped, thickest near the apex, and somewhat hump-backed. Both the basal cup and the terminal lobe of the lip differ in shape, the latter being long and narrow in A 1, shorter, broader, and recurved in B 1. The column in A 1 is divided into two parts, but undivided in B 1. The anther in A 1 is very decidedly stalked, slender, acute, and projects well over the upper edge of the stigma; in B 1 it is sessile, thicker, more obtuse, and does not project over the stigma at all. In A 1 the pollinia project over the stigma, in B 1 they are entirely behind it. In A 1 the rostellum has disappeared (the flower having been open some hours); in B 1 it is large and persistent.

In A 2, a back view of the column of *viridiflora*, the stalk on which the anther is perched, and the tapering of the anther to an acute point, contrast strongly with B 2, a similar view of *latifolia*. A 3, a front view of the column of *viridiflora*, shows how the pollinia (*p.*) emerge over the upper edge of the stigma, forming a wide inverted **V** or horse-shoe, with a dark spot (*r.*) in the apex, the withered remains of the rostellum; the projection on the right is an abnormally developed staminode (*st.*), within which a yellowish rudimentary pollinium (*p.*) could be seen. B 3, a similar view of *latifolia*, shows the large persistent rostellum. C 1, C 2, and C 3 show similar details of *E. violacea*.

These figures were drawn from living specimens by my wife, who at the time was not familiar with the differences between the species, and simply drew what she saw. They are not therefore open to the objection of unconscious exaggeration by an artist with preconceived ideas.

It will be seen from the above that there are marked differences both in the vegetative and in the reproductive organs of the plants. Whilst variations in size and shape occur in the leaves, bracts, and perianths of orchids, often amounting to several, or even to many millimetres in extent, without affecting prejudicially the welfare of the plant, the organs of reproduction themselves are fashioned with the utmost exactitude. Every part must be faultless in form and dimension, and all the parts co-ordinated with absolute precision. Deviations which would be unimportant in other parts of the plant would here be fatal, and throw the delicate mechanism out of gear, causing the plant to fail to perpetuate its kind. For this reason variations in the structure of the reproductive organs are relatively of much greater importance than any that occur in the vegetative parts of the plant, for while the latter can only affect the individual, the former threaten the continuity of the species. Consider, for instance, the anther in *Anacamptis pyramidalis*, which has to be placed with such unfailing accuracy that the caudicles of the pollinia shall find their way to and attach themselves exactly to the minute viscid disc of the rostellum (which is part of the stigma). The viscid disc is saddle-shaped, and when withdrawn by an insect curls round its proboscis, thereby causing the pollinia to diverge, so that, after the movement of depression has taken place, they are pointing forward and outward at such an angle that their tips will touch the stigmas when the proboscis is inserted into another flower. In this plant there are two stigmas separated by a median space. If the ends of the caudicles fasten themselves to the viscid disc too close together, they will not diverge enough when the disc curls round the proboscis, and would strike the median space between the two stigmas. If, however, they are cemented too far apart, they would diverge too much, and would touch points outside the effective stigmatic area. This example is enough to show the necessity of accurate standardization in the reproductive parts of the flower. Any new departure in these essential organs is therefore of paramount importance. If differences in the leaves, bracts, and floral envelopes are sufficient ground for specific distinction—and they are commonly so regarded—differences in the essential mechanism of reproduction are of still greater weight.

If adequate consideration is given to the above-mentioned morphological differences between *E. latifolia* and *E. viridiflora*, they should be amply sufficient to prove that these plants are specifically distinct. The clearness of view of the elder Reichenbach is all the more remarkable, in that he recognized this apart from the evidence of the structural differences in the reproductive organs. It is curious that the younger Reichenbach, who made such excellent anatomical drawings of so many orchids, should have omitted to do so in the case of *E. viridiflora.* He does not seem to have suspected any difference of structure as compared with *E. latifolia.*

Moreover, these morphological differences involve remarkable functional changes. *E. latifolia* is fertilized by wasps, to whose forehead the viscid gland becomes firmly attached, so that the pollinia are bodily and cleanly withdrawn, and carried to another flower. The pollen is not friable, and only when it comes in contact with the viscid stigma of another flower are fragments detached. Self-fertilization appears to be impossible; the pollinia lie at the back of the stigma, and can only be removed by some external agency. If not withdrawn, they wither *in situ.*

In *E. viridiflora* var. *leptochila* the viscid gland is present in the newly-opened flower, but it is inoperative. If touched with any suitable object, it does not adhere to it as a whole; a few strings of viscid matter can be withdrawn, but these are far too weak to remove the pollinia, which ordinarily do not come into contact with the rostellum. Once, indeed, I succeeded in removing a small fragment of pollen adhering to the viscid gland, but I am inclined to think that in touching the gland with a pencil I probably pressed it out of place, and caused it to come in contact with the pollinium, which it would not otherwise have done. By the time the next flower above it has opened, the viscid gland has disappeared, leaving a small brownish mark which indicates its former position (fig. A 3, *r.*). Fertilization by insects does not occur, or if it happens on rare occasions, only minute fragments of pollen can be transferred.

The anther projects over the upper edge of the stigma for upwards of half its length. The club-shaped pollinia are joined at the apex, whilst their thickened lower ends are slightly divergent, forming an inverted V. Owing to the forward position of the anther, the viscid gland, instead of being immediately opposite the point of junction of the pollinia, as in *E. latifolia*, is opposite the V-shaped space between them. As the anther is face downwards in its natural position, when the anther-cells open, the pollinia sink downwards, and their apices not being arrested by the viscid gland, they pass over it, sliding down over the sloping upper edges of the stigma, and finally coming to rest on its frontal viscid surface (fig. A 3, *p.*). At the same time a marked change comes over them. They increase noticeably in size, and become fluffy in appearance. An outgrowth of pollen-tubes occurs, causing them sometimes to appear hairy under a powerful lens. These penetrate the stigma, anchor the pollinia, and fertilize the ovary in the usual way. Self-fertilization thus appears to be inevitable, and the subsequent vigour of the capsules shows its effectiveness.

In *E. viridiflora* var. *dunensis* (J. B. 1913, p. 343, and 1918, p. 1) the pollen is so friable that, even before the flower opens, numerous tetrads of pollen, looking like single pollen grains, fall on the lip. I did not observe a single instance of this in *leptochila.* I have seen minute portions of pollen adhering to the inner walls of the anther-cells, but as a whole the pollen remains *in situ* on the pollinia. Hermann Müller says that in the Westphalian plant the whole pollinium becomes felted together by pollen-tubes, so that in the later stages pollen can only be detached by forcible removal (Verhandl. des N. H. Vereines der preuss. Rheinlands, &c., 1868). The same is the case with our plant. He also says that nothing whatever is to be seen of a rostellum (which with us is visible in bud and early flower), and that the whole pollinia emerge over the edge of the stigma, forming two pyramids, whose bases rest on its upper surface. With us only their upper portions so emerge, their bases remaining behind the stigma.

There can be no reasonable doubt that *E. viridiflora* was originally fertilized by insects. The fact that the cup at the base of the lip still glistens with nectar, and the presence of a viscid gland in newly-opened flowers, show clearly that the flower was designed to attract insects.

Müller believed that cross-fertilization might occasionally occur with *E. viridiflora.* He found aphides sucking nectar, in one case with adherent grains of pollen. He also many times observed small insect larvæ (Thrips ?), sometimes with a few pollen-grains on the head and back (*l. c.*). I saw similar larvæ and aphides in the flowers of the Surrey plant, and, like Müller, noticed one or two specimens of the latter stuck fast on the stigma, and dead. It is quite possible, therefore, that these small creatures may carry a few pollen-grains from one flower to another, but whether they are likely to convey them from one plant to another is perhaps doubtful, as it is scarcely probable that they would leave a plant where they have abundant food. If cross-fertilization occurs in this way it is probably accidental, self-fertilization is the rule. I repeatedly saw *E. latifolia* and *E. violacea* visited by wasps, and several times caught these insects with pollinia on their heads. I saw no insects visit *viridiflora*, but I had not so many opportunities for watching the latter plant.

Müller studied most minutely the reproductive organs of *E. viridiflora*, both from a morphological and physiological point of view, in comparison with *E. latifolia*. His opinion therefore is of more weight than that of those botanists who have confined their observations to the more obvious characters of the leaves, bracts, and perianth: he says (*l. c.*) that we have in *E. latifolia* and *E. viridiflora* two form-cycles which differ from one another by thoroughly essential characters, and have the same claim to be considered distinct species, as any two species of a genus.

Explanation of Plate 553.

A. *Epipactis viridiflora* var. *leptochila*. B. *E. latifolia*. C. *E. violacea*. 1. Side view of flower, sepals and petals removed. 2. Back view of column. 3. Front view of do.: *a.*, anther; *p.*, pollinia; *o.*, ovary; *r.*, rostellum; *s.*, stigma; *st.*, staminode.

THE UREDINEÆ OF WEST SOMERSET.

By Norman G. Hadden.

As there appears to be no published account of the Rust Fungi of the district with which this paper deals, it may be as well to put on record those species which I have observed here during the last four years. The district covered is a narrow strip about twelve miles in length and four in width, forming the extreme north-western corner of Somerset: it is bounded on the north by the Bristol Channel, on the south by Exmoor Forest and on the west by the Devon county boundary-line. Taking the village of Porlock as the centre, all the species recorded have been found within a few miles' radius. Owing to the variety of plant associations in the neighbourhood, the list of *Uredineæ* is a long one and includes a number of rare and interesting species. The salt-marshes, rich pasture land, large old woods, young plantations and open moorland naturally support a great variety of phanerogamic plants with the consequent number of parasitic rusts.

I am greatly indebted to Mr. Carleton Rea for his kindness in assisting me in the determination of some of the more critical species.

The nomenclature adopted in the following list is that employed by Mr. J. Ramsbottom in his list of British Uredinales, published in the *Transactions of the British Mycological Society*, vol. iv.:—

Uromyces Ficariæ Lév. On *Ranunculus Ficaria*, frequent.—*U. caryophyllinus* Schroet. On border Carnations in my garden—

U. sparsus Lév. On *Spergularia salina.* Porlock marsh; locally common.—*U. Anthyllidis* Schroet. On *Anthyllis Vulneraria.* Culbone Cliffs; scarce.—*U. Ervi* Westend. On *Vicia hirsuta.* Porlock.—*U. Loti* Blytt. Porlock marsh, rare.—*U. striatus* Schroet. On *Trifolium minus* on a lawn at Porlock.—*U. Orobi* Lév. Porlock and Culbone woods, scarce.—*U. Trifolii* Lév. Porlock Hill.—*U. flectens* Lagerh. Frequent in fields and on roadsides.—*U. Fabæ* de Bary. Abundant on Broad Beans; occasionally on *Vicia sepium.*—*U. Alchemillæ* Lév. Oare; uncommon.—*U. Valerianæ* Fuckel. On *Valeriana sambucifolia,* abundant.—*U. Armeriæ* Lév. Porlock marsh, rare.—*U. Betæ* Tul. On *Beta maritima.* Bossington.—*U. Salicorniæ* de Bary. Porlock marsh; appearing every summer.—*U. Polygoni* Fuck. Frequent on arable land.—*U. Rumicis* Wint. Common.—*U. Acetosæ* Schroet. Weir Water, Exmoor.—*U. Scillarum* Wint. Frequent.—*U. Dactylidis* Otth. Teleutospores abundant; æcidia not yet seen here.—*U. Poæ* Rabenh. Æcidia abundant on *Ranunculus Ficaria.*

Puccinia Violæ DC. Common.—*P. ægra* Grove. Not uncommon in gardens on cultivated *Viola tricolor.*—*P. Fergussoni* B. et Br. On *Viola palustris*; rare. Exe Cleave near Simonsbath.—*P. Arenariæ* Wint. On *Arenaria trinervia.* Porlock woods; forma *lychnidearum* Link. On *Lychnis diurna.* Common.—*P. Silenes* Schroet. On *Silene maritima,* rare. Porlock marsh.—*P. Malvacearum* Mont. Abundant.—*P. Pruni-spinosæ* Pers. Æcidia on *Anemone coronaria* in a Porlock garden.—*P. pulverulenta* Grev. On *Epilobium hirsutum* and *E. montanum.* Common.—*P. Epilobii* DC. Rare. On *E. palustre.* Exmoor and North Hill.—*P. Circææ* Pers. Common.—*P. Umbilici* Guép. On *Cotyledon Umbilicus.* Frequent.—*P. Conii* Fuckel. Minehead Warren; scarce.—*P. Æthusæ* Mart. Rather common.—*P. Pimpinellæ* Mart. On *Pimpinella Saxifraga.* Pitt Farm, rare.—*P. Saniculæ* Grev. Frequent.—*P. Smyrnii* Biv. Porlock and Minehead, common.—*P. albescens* Grev. On *Adoxa Moschatellina*; Æcidia appear in March.—*P. Adoxæ* Hedw. fil. Teleutospores only. Porlock woods.—*P. punctata* Link. On *Galium verum.* Porlock.—*P. Asperulæ-odoratæ* Wurth. Horner Woods; rare.—*P. Cardui pycnocephali* Sydow. Minehead Warren, rare.—*P. Carlinæ* Jacky. Mill Hill, Exmoor.—*P. Centaureæ* Mart. Common.—*P. obtegens* Tul. Abundant.—*P. Cirsii* Lasch. Not uncommon.—*P. Cnici-oleracei* Pers. Common.—*P. Crepidis* Schroet. On *Crepis virens.* Frequent.—*P. Hieracii* Mart. Abundant.—*P. Hypochœridis* Oud. Common.—*P. Lapsanæ* Fuck. Abundant.—*P. Leontodontis* Jacky. Porlock, uncommon.—*P. senecionis* Libert. On *Senecio Jacobæa.* Porlock.—*P. Virgaureæ* Libert. On *Solidago Virgaurea.* Porlock and Culbone woods.—*P. Sonchi* Roberge. On *Sonchus oleraceus,* rare. Bossington.—*P. Taraxaci* Plow. Common.—*P. Primulæ* Duby. Frequent.—*P. Vincæ* Berk. On *Vinca major,* rather common.—*P. Veronicæ* Schroet. On *V. montana,* rare. Selworthy woods.—*P. Glechomatis* DC. Uncommon. Horner woods.—*P. Menthæ* Pers. Abundant on garden mint, *M. aquatica,* and *Calamintha.*—*P. annularis* Schlecht. On *Teucrium*

Scorodonia. Porlock woods.—*P. Acetosæ* Koern. Rather common.—*P. Polygoni-Convolvuli* DC. West Porlock and Bossington; uncommon.—*P. Iridis* Wallr. On *Iris fœtidissima* in gardens.—*P. oblongata* Wint. On *Luzula pilosa.* Culbone woods.—*P. obscura* Schroet. Æcidia on *Bellis perennis,* teleutospores on *Luzula.*—*P. Caricis* Rabent. Æcidia on *Urtica dioica,* teleutospores on *Carex.* Common.—*P. sylvatica* Schroet. Æcidia on *Taraxacum.* Porlock woods.—*P. graminis* Pers. On *Dactylis,* common. Æcidia on *Berberis* not seen.—*P. coronata* Corda. Uredospores on *Agrostis.*—*P. Lolii* Niels. Uredospores on *Lolium, Avena* and *Arrhenatherum.* Common.—*P. Agropyrina* Eriks. On *Agropyron repens,* rather common.—*P. Anthoxanthi* Fuckel. Porlock woods; rare.—*P. Baryi* Wint. On *Brachypodium sylvaticum.* Porlock; uncommon.—*P. Festucæ* Plowr. Teleutospores on *Festuca ovina.* Porlock.—*P. Phragmitis* Koern. Æcidia on *Rumex,* teleutospores on *Phragmites.* Common.—*P. Poarum* Niels. Æcidia on *Tussilago Farfara*; common.

Triphragmium Ulmariæ Link. On *Spiræa Ulmaria.* Exford.

Phragmidium Fragariastri Schroet. Common.—*P. Sanguisorbæ* Schroet. On *Poterium Sanguisorba* in a garden at Lynch.—*P. subcorticium* Wint. Abundant on wild and cultivated Roses.—*P. albidum* Ludw. Frequent on *Rubus fruticosus.*—*P. Rubi* Wint. Rather scarce.—*P. violaceum* Wint. Abundant.—*P. Rubi-idæi* Karst. Common.

Coleosporum Euphrasiæ Wint. On *Euphrasia, Rhinanthus* and *Bartsia.* Common.—*C. Melampyri* Kleb. Teleutospores frequent on *Melampyrum.* Æcidia found on *Pinus sylvestris* probably belong to this species.—*C. Petasites* de Bary. Rather scarce. Bossington.—*C. Senecionis* Fr. Abundant.—*C. Tussilaginis* Kleb. Common.—*C. Sonchi-arvensis* Lév. Abundant.

Pucciniastrum Circææ Schroet. Porlock; scarce.—*P. Vacciniorum* Diet. Common.

Uredinopsis Scolopendrii Rostr. Porlock woods; not uncommon.

Melampsora Helioscopiæ Cast. Abundant.—*M. Hypericorum* Schroet. On *Hypericum Androsæmum*; scarce.—*M. Larici-capre arum* Kleb. Common.—*M. Rostrupii* Wagn. Cœomata on *Mercurialis perennis.* Luccombe.

Melampsoridium betulinum Kleb. Abundant; especially on seedling birches.

Melampsorella caryophyllacearum Schroet. Teleutospores on *Cerastium vulgatum* and *Stellaria Holostea.* West Porlock and Horner woods—*M. Symphyti* Bubák. Bossington.—*M. Blechni* Sydow. Scarce: Porlock woods and Exmoor.—*M. dieteliana* Sydow. On *Polypodium vulgare.* Porlock woods.

POLLINOSIS ("HAY-FEVER").

By E. Philip Smith

(Botanic Department, Oxford).

For catarrh caused by plant-products, and especially by the microspores or pollen-grains of the Gramineæ, the expression "pollinosis" has been used; this is preferable to the older "hay-fever," as being less ambiguous, more accurately descriptive, and not so liable to misuse. Under the popular term "hay-fever" are classed together almost as many abnormal conditions of the nasal membranes as under the heading of "common cold," regardless of their etiology. Any nasal catarrh, whether it merely takes the form of abnormal secretion of mucus, or is accompanied by violent sneezing, running of the eyes, and even by severer systemic symptoms, if it is not more or less directly referable to bacterial infection consequent upon exposure to cold, etc., is, especially if it occurs in the summer or autumn, unhesitatingly described as "hay-fever."

For the purpose of these notes, it is proposed to set aside all types of corrhiza which prove upon inquiry to be due to causes other than plant-products, such as those caused by exposure to the dense dust which gathers in libraries, by exposure to bright light—this will be touched upon later—or by the animal detritus from the coats of horses, cats, and even dogs. Even when circumscribed by the removal of these other types, the definition of hay-fever is sufficiently wide to make it of interest to many, and of painful interest to its victims.

The clinical picture is well known. The onset of the attack, which may follow directly on exposure to pollen, or after the lapse of a certain time varying from five minutes to half an hour, is marked by violent sneezing, profuse secretion of watery mucus, running at the eyes, and a feeling of helplessness and malaise. In some subjects nasal and bronchial stenosis may be felt at the height of the paroxysm. This primary attack may last only a few minutes, or it may be prolonged until the patient is exhausted, and fresh paroxysms occur on each new exposure to the source of irritation. After some days of this the nasal mucosa, the conjunctival surfaces, and even the bronchi in severe cases, become acutely sensitive, and very little is required to produce an attack, even without further exposure to pollen, the stirring up of dust from books, a draught of cold air, even exposure to bright light (in cases where the eyes are much involved) being sufficient. If it were always possible accurately to disentangle the evidence, it would be possible to make a clear distinction between *primary attacks* due to direct infection, and these *secondary effects* of other irritants on an already damaged mucous membrane. The danger-season, however, is so prolonged (with some it begins with the flowering of Willows), lasting from spring till the first frost in autumn, that few people could submit to the rigid exclusion from vegetation which would be necessary for an accurate experiment to be made on the relative importance of the primary and secondary causes.

Enough has been said to show that true hay-fever is sufficiently widespread to make it of interest to the botanist to study the plant-products which cause it from a purely technical standpoint, in contrast to that of the immuno-chemist, which dominates current literature. The standpoint from which the problem has hitherto been approached is that of the immunologist, who interprets the phenomena observed in terms of toxins and antibodies, of protein-sensitization and anaphylaxis. The earliest notable work in this line is that of Dunbar and Prausnitz. These workers made an elaborate investigation into the toxicity of various kinds of pollen, using an extract of the pollen-protein in very dilute solution of sodium chloride. The following is a summary of the commoner plants in their list, which includes 25 Gramineæ and 8 Cyperaceæ, as well as numerous other forms.

I. Grasses, as:—*Phleum pratense, Agrostis alba, Poa pratensis, Anthoxanthum odoratum, Dactylis glomerata, Secale cereale, Triticum sativum, Agropyrum repens.*

II. Various plants, as:—*Robinia Pseudacacia, Castanea dentata, Acer rubrum, Chrysanthemum Leucanthemum, Rosa* spp., *Lonicera Caprifolium, Ligustrum vulgare.* (No indication is given as to which of the latter plants are common causes of hay-fever and which are merely rare instances.)

The following plants which cause late hay-fever are mostly found in the United States, namely:—*Ambrosia trifida, A. artemisiæfolia, Solidago canadensis, S. nemoralis, Chrysanthemum* sp., *Dahlia, Clematis virginiana,* and *Aster* spp.

In addition to these, the following grasses are given by Macdonald as causing hay-fever in this country:—*Poa pratensis, P. trivialis, P. nemoralis, Arrhenatherum avenaceum, Lolium perenne,* and *Alopecurus pratensis.*

From personal experience, the following Gymnosperm pollens were effective:—*Abies concolor, Pinus excelsa, Pinus Pinsapo.* After prolonged exposure (40–50 minutes) to the pollen of *Pinus excelsa* while harvesting it, slight symptoms were felt: *i.e.* irritation of the eyes and nose, feeling of intense dryness in the posterior nasal cavities. Later in the same day exposure for a few minutes to a mixed hayfield (*Phleum pratense* being the principal grass in flower), produced an acute attack, quite characteristic, with implication of the bronchi and distinct rise of temperature. After this initial attack, fresh exposure to *Pinus*-pollen reproduced it with monotonous regularity, after an "incubation period" of about 10 minutes. For the succeeding four weeks every effort was made to avoid accidental infection with grass or other pollen, and during the intervals between the purposeful exposure to pollen of various kinds, the symptoms were slight and in fact almost negligible. Each attempt at excitation by direct insufflation of pollen was successful in producing an attack. The pollen used principally was *Pinus excelsa*, owing to the ease with which large quantities were obtainable. The susceptibility to *Phleum* made laboratory experiments with grass-pollen almost impossible, owing to the difficulties of harvesting. For an account of experimental pollinosis in animals, see Ulrich, in the *Journal of Immunology*, Nov. 1918.

Unfortunately the lists previously given are not strictly comparable, as the results were obtained by different methods. The method used originally by Dunbar and extended by Cooke and Vander Veer, and again by Cooke, Flood, and Coca, was to prepare an extract of the pollen-proteid by means of grinding up the pollen (in the manner usual for enzyme-abstraction) with sand, extracting the mass with distilled water by alternate freezing and thawing, or extracting with ·8 % NaCl in $\frac{N}{100}$ NaOH. The product was precipitated by acetone, redissolved in ·8 % NaCl, and standardized for nitrogen-content by Kjeldahl's method. The toxicity was tested by applying the solution at a known nitrogen-content to the conjunctiva, and by intradermal injection. If the application produced lachrymation and sneezing, and an itching weal at the point of injection, the result was positive, and the subject considered sensitive to that particular pollen-protein. The results obtained in this way are interpreted differently by the different observers. Hay-fever is described: firstly, as due to a *toxin* ("toxalbumin") (Dunbar); secondly, as an *anaphylactic reaction* (Cooke); and, thirdly, as a clinical symptomatic expression of local *spontaneous hypersensitiveness*, the active pollen-substances *not being toxins* (Cooke, Flood, Coca). These discordant results may perhaps be explained as arising from the unnatural experimental conditions, for under ordinary circumstances the nasal mucosa are not directly placed in contact with pollen-proteid. There intervenes the highly effective protective mechanism of the cuticularized microspore-wall. It is true that in the Angiosperm pollens there are pores of various kinds in the wall, but the mechanism by which colloidal protein is to pass through a cellulose membrane is not explained. The digestive power of the nasal mucosa is very slight, and in any case there is no means of digesting cellulose there. The unbroken, ungerminated pollen-grain is effectively sealed to protect its contents from desiccation or undue wetting (in the case of wind-pollinated forms like the grasses and *Pinus*), and conversely it is difficult to understand how any of the protein-contents could *passively diffuse* out. Possible germination-effects may also be set aside: even under the most favourable circumstances grass-pollen does not germinate within five minutes (*i. e.* minimum "incubation-time" observed), and in the case of Gymnosperm-pollen the question does not arise.

In the case of Angiosperm pollen, however, where the wall is porose, the osmotic pressure of the grain (amounting to several atmospheres) may be of importance, as leading to the withdrawal of water from the adjacent membrane, with consequent swelling of the grain and liberation of its contents through bursting. In this way the alien protein would be brought into contact with the epithelial cells. The irritation caused by the withdrawal of water by the grain must also be quite considerable, having regard to the relative sizes of the ciliated cells (6 μ diam.) and pollen grains (30–50 μ). Thus a single 80 μ grain of *Pinus excelsa* would drain over a hundred epithelial cells.

It would be quite outside the scope of these notes to attempt to deal with the question of protein-sensitization, which has been exhaustively treated in the papers already mentioned. Having discussed the mechanism by which pollen-proteid can come into contact with the nasal mucosa, the cell-contents may be dismissed from the rôle of active agent. It remains to consider:—

(1) The question of the mere *mechanical irritation*, due to the presence of a foreign body, being sufficient to cause the symptoms.
(2) The possibility of some substance on the outer wall (exine) of the grain being responsible.

In answer to the first question, it may be said that the presence of foreign bodies on an otherwise undamaged mucous membrane may produce transient sneezing and secretion, but nothing like a real paroxysm. Of course, where the foreign body is atmospheric dust, which may contain particles of alien protein, grit, etc., the irritation may be more pronounced; and such irritation, or even the action of cold air, superimposed upon a previous catarrhal condition, may, as mentioned before, produce effects very similar to a primary hay-fever attack. The second point is more difficult and more important. The microspores of Angiosperms and Gymnosperms are formed in tetrads within the microsporangium, which is lined by a nutritive tapetum. This tapetal layer furnishes food-material for the developing spores, but disorganizes before they are shed. Consequently the pollen-grains are coated on the outside, as is seen in the yellow colour, by tapetal débris, which may be almost anything (commonly oily matter), and in which it is conceivable that *protein* and *enzyme-residues* may be present in minute quantities. The yellow colour of many pollen-grains is in all cases outside the cuticle, and consists of carotin dissolved in a film of oil. The function of this oil is conjectural, but it may conceivably assist in sealing the grain still better, protecting it from excessive wetting, and preventing the grains from adhering (*cf.* the curious way in which *Pinus* pollen "pours"). From analogy with the well-known irritant oils in *Primula obconica*, *P. sinensis*, etc., it seemed probable that this oily film on the pollen-grains was the irritant principle, and experiments were undertaken to demonstrate this, but the results are not yet collected. For example, a suggestive preliminary trial was made with the pollen of *Hibiscus*. The pollen was shaken up with cold ether, the ether then being filtered off and allowed to evaporate. The oily residue, when applied to the unbroken skin of the fore-arm, raised a severe blister, almost as bad as that produced by Poison Ivy (*Rhus Toxicodendron*).

This would seem to indicate a more natural method of approaching the problem, being based upon a botanical consideration of the microspores involved. It is quite possible that most microspores are coated with a film of oil, but only a certain number of pollens are produced in sufficiently large quantities to be of any practical importance. This includes the wind-pollinated trees, both Angiosperms and Gymnosperms, and the Grasses, particularly the common hay-grasses. Species of *Plantago* also give much pollen, and a laboratory trial with *Plantago*-pollen alone gave a positive result. If this idea that one of the poisonous principles of pollen is merely that of an irritant oil is correct, it will throw a new light on the nature of the damage done to the nasal mucosa (for it is obvious that an oily substance which will raise a severe blister upon the unbroken epidermis will have a still more destructive action on the delicate ciliated epithelium lining the nasal cavities, and on the underlying nerve-endings), perhaps suggesting new lines of treatment. It will also serve to bring the phenomena into line with the well-known cases of Plant-Dermatitis, which cover quite a wide range of plant-organisms in this country, and which present even more striking examples in the tropics.

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ALABASTRA DIVERSA.—PART XXXII.*

BY SPENCER LE M. MOORE, B.Sc., F.L.S.

1. PLANTÆ CONGOENSES NOVÆ VEL RARIORES.

DR. WERNHAM has already (Journ. Bot. 1918, pp. 308–313) published descriptions of new *Rubiaceæ*, from the Belgian Congo, forming part of a collection brought to the Museum by Dr. Vermoesen, Inspector of Agriculture in that country. An examination of the *Compositæ* and *Acanthaceæ* has yielded the results presented in the following pages:—

COMPOSITÆ.

MSUATA BUETTNERI O. Hoffm.

Chenal; *Vanderyst*, 4505.

This is the representative of a monotypic genus hitherto absent from the London herbaria.

TRIPLOTAXIS STELLULIFERA Hutchins.

Boyeka, near Coquilhatville; *Nannan*, 95.

One of the plants used to stupefy fish.

Vernonia (§ *Stengelia*) **divulgata**, sp. nov. *Caule* simplici vel subsimplici e collo fusco-villoso ascendente superne nudo eximie striato puberulo; *foliis* sessilibus plerumque radicalibus (prepaucis sæpe ex caule oriundis) oblongo-oblanceolatis vel obovatis obtusissimis inferne in partem petioliformam basi dilatatam extenuatis firme

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* Types of the species here described are in the National Herbarium.

membranaceis utrinque eleganter reticulatis nitidisque leviter scabriusculis; *capitulis* submediocribus circa 30-flosculosis in corymbum elongatum optime laxum ordinatis pedunculis propriis quam involucra manifeste longioribus; *involucri* subhemisphærici 4-serialis puberuli phyllis oblongis interioribus gradatim longioribus appendice brevi obtusissima (intimorum angustiori necnon acuta) in sicco brunnea coronatis; *corollis* exsertis; *achæniis* cylindricis callo basali sat prominente instructis 5-costatis breviter setulosis; *pappi* setis scabriusculis dilute stramineis paucis extimis abbreviatis.

Gamboni; *Vanderyst*, 3658. Wombali, abundant in places; *Id.*, 4217. Bandunvu; *Id.*, 5171.

Folia radicalia plerumque circa 8–10 × 2–4 cm., quam caulina majora vel minora horum summa sæpe magnopere imminuta. Inflorescentia longit. 50 cm. sæpe attingens, ramis striatis puberulis. Capitula pansa circa 10 mm. long. Involucrum 8·5 mm. long.; phylla extima circa 3 mm., intermedia 4·5–7 mm., intima 8 mm. long. Corolla 11 mm, long.; tubus anguste infundibularis quam lobi lineari-oblongi manifeste longior. Styli rami exserti, 2·5 mm. long. Achænia adhuc vix matura ægre 3 mm. long. Pappi setæ extimæ 1 mm., ceteræ 5–7 mm. long.

Though apparently a common plant, I have been unable to identify this from the descriptions of species unseen by me. A reason for this may perhaps be that it has been mistaken for *V. præcox* Welw., which it greatly resembles, differing chiefly in the foliage (slightly only) and the shape of the involucral leaves.

O. Hoffman would have placed this in his § *Lachnorrhiza*, but, as has been mentioned elsewhere, it seems inadvisable to disregard the involucres in the case of a few species, seeing how convenient for sectioning purposes the involucre has proved itself.

Aspilia congoensis, sp. nov. *Caule* saltem superne sparsim ramoso tereti striato scabriusculo; *foliis* brevipetiolatis lanceolatis acuminatis apice ipso acutis basi obtusis trinervibus margine serrulatis firme membranaceis supra scabridis subtus sparsim pubescentibus; *capitulis* mediocribus in corymbos laxos bracteatos oligocephalos digestis; *pedunculis propriis* involucris plerumque longioribus; *involucri* subhemisphærici phyllis 3-serialibus ovato-oblongis exterioribus superne herbaceis et obtusis et scabridis necnon plus minus reflexis intimis apice herbaceis acutisque; *ligulis* 10 sat alte bifidis; *achæniis* compressiusculis anguste ovoideo-oblongis pilis brevibus appressis strigillosis onustis cupula sat perspicua setis carente coronatis.

Upper Welle province; *Lacomblez*, 67.

Folia usque ad 9–10 × 2–2·5 cm., pleraque vero minora, *e.g.* ±6 × 1·2 cm., in sicco griseo-fusca; petioli latiusculi, 2–4 mm. long. Bracteæ foliis similes sed minores, plerumque 1·5–3 cm. long. Pedunculi proprii 1–2 cm. long. Involucra circa 8 × 8 mm.; phylla extima 4 mm., intermedia 4·5 mm., intima 5 mm. long. Ligulæ aurantiaceæ, 10 × 2·5 mm. Recepticuli paleæ oblongæ, apice indurato-mucronatæ, 7 mm. long. Achænia dilute grisea, fusco-purpureo-maculata, 4 mm. long. (pappo 1 mm. long. incluso).

To be inserted in the genus close to *A. asperifolia* O. Hoffm., but easily distinguished on account of the lanceolate leaves, longer proper peduncles and 10-rayed heads with narrower involucral leaves.

Crassocephalum longirameum, sp. nov. *Herba* erecta verisimiliter circiter 2-spithamea; *caule* pauciramoso quadrangulari subdistanter folioso minute puberulo postea glabro; *foliis* sessilibus linearibus acutis obtusisve supra glabris subtus minute pubescentibus; *capitulis* corymbum terminalem folia plane excedentem bracteatum oligocephalum constituentibus; *involucri* obovoidei puberuli phyllis 8 inter se inæquilatis oblongis acutis dorso eleganter striatis margine anguste membranaceis; *flosculis* ultra 50 exsertis verisimiliter flavis; *styli* ramis appendice filiformi elongata præditis; *achæniis* (hucusque crudis) linearibus 5-costatis costis minute pilosulis; *pappi* setis scabriusculis albis.

Bandundu; *Vanderyst*, 3562.

Folia usque 5 cm. long., sed plerumque breviora, superiora gradatim imminuta, applanata summum 2 mm. lat., marginibus revolutis vero circa 1 mm. Bracteæ anguste lineares, ± 5 mm. long. Capitula pansa 8 × 10 mm. Involucrum 6 mm. long. Corollæ inferne angustissimæ, superne gradatim dilatatæ, 7 mm. long. (inclusis lobis linearibus longit. 2 mm. paullulum excedentibus). Styli rami in toto 2·2 mm. long., horum appendix 1 mm. Achænia circa 1 mm., pappus 5 mm. long.

This would be taken on sight for an *Emilia*. The narrow leaves and curiously long appendages to the style-arms are easily recognized peculiarities.

ACANTHACEÆ.

HYGROPHILA GIGAS Burkill (*H. Gilletii* De Wild. ex ic. et descript.). Bokala; *Vanderyst*, 4824.

The type-specimen, a small one in the Kew herbarium, agrees exactly, so far as it goes, with the excellent figure of *H. Gilletii* in Ann. Mus. Congo, sér. v. i. 314.

Hygrophila (§ *Eu-Hygrophila*) **Vanderystii**, sp. nov. Herba 2½-spithamea; *caule* basi repente hac atque illac radicante inde erecto fere omnimodo folioso tetragono nodis pilosis exemptis glabro; *foliis* sessilibus anguste lineari-lanceolatis superioribus linearibus in marginibus costaque centrali pag. inf. appresse subsparsim scabridis; *floribus* pro axilla paucis subsessilibus foliis floralibus linearibus ciliatis calyce sæpe longioribus stipatis; *calycis* triente inferiori gamosepali segmentis inter se fere æqualibus anguste linearibus acutis; *corollæ* tubo calyce breviore inferne contracto limbo quam tubus paullo breviore labio postico plicato lobo intermedio quam laterales latiore; *filamentis* basi per paria coalitis; *ovario* oblongo acuto glabro; *ovulis* pro loculo fere 20.

Wombali; *Vanderyst*, 4255.

Planta circiter 50 cm. alt. Folia pleraque 4–6 cm. long., pauca inferiora 4 mm. lat., cetera 1·5–2·5 mm., in sicco fuscescentia. Folia floralia usque 12 mm. long. Calyx 10 mm. long. Corolla 12 mm. long.; tubus 7 mm. long., 1–1·5 mm. lat., sub limbo 3 mm.; labia 5 mm. long., lobis circa 1·5 mm. Ovarium 2·5 mm. long., minute puberula. Stylus 6·5 mm. long.

Known by its narrow leaves and small flowers with calyx-lobes almost equal among themselves.

BRILLANTAISIA PATULA T. And.

Upper Welle and Ituri rivers; *Lacomblez*, 80. Dumu, *Vanderyst*, 4978. Var. *Welwitschii* Burkill. Boyeka near Coquilhatville; *Nannan*, 33.

WHITFIELDIA LONGIFOLIA T. And. Yambata; *Moutchal*, 183. Chenal; *Vanderyst*, 4501. Tua, common in the forests; *Vanderyst*, 4862, 4974.

PHAYLOPSIS OBLIQUA S. Moore. Buyumu; *Vanderyst*, 4296.

BARLERIA ALATA S. Moore. Dumu; *Vanderyst*, 4840. Bokala; *id.*, 4980.

ERANTHEMUM NIGRITIANUM T. And. Kimbwa and Bokala; *Vanderyst, sine no.*—E. HYPOCRATERIFORME Roem. & Sch. Leopoldville; *Vanderyst*, 3018.

JUSTICIA INSULARIS T. And. Kitebe; *Vanderyst*, 4126.

Justicia (§ *Calophanoides*) **fistulosa**, sp. nov. *Herba* erecta, ramosa, subsparsim foliosa; *ramis* erecto-adscendentibus tetragonis uti caulis fistulosis necnon parce puberulis et sub nodis tumidis breviter pubescentibus; *foliis* brevipetiolatis ovatis obtusissimis nisi rotundatis basi rotundatis margine undulatis in nervis pag. inf. breviter appresseque pubescentibus; *floribus* axillaribus pro axilla paucis subsessilibus; *bracteolis* 0; *calycis* segmentis 5 inter se quadammodo inæqualibus linearibus acutis ciliatis; *corollæ* tubo calycem breviter superante dimidio inf. coartato superne dilatato limbi labiis subæquilongis lobis omnibus ovatis obtusis; *ovario* ovoideo-oblongo minute puberulo; *stylo* basi sparsim piloso; *capsula* puberula.

Bokala; *Sparano*, 26.

Folia 4 × 2·5–3 cm. attingentia, plerumque vero ± 2 × 1·5 cm., in sicco sursum brunnescentia, inferne viridia; petioli 2–6 mm. long., pubescentes. Calyx 5–6 mm. long.; hujus segmenta breviora 4 mm., longiora 5 mm. long. Corolla 13 mm. long.; tubus 7 mm. long., dimidio inferiori circa 1 mm. lat., sub limbo 2·5 mm.; labia 6 mm. long., posticum 3 mm., anticum 4 mm. lat.; amborum lobi 1·5 mm. long. Discus prominens, 1 mm. alt. Ovarium vix 2 mm. long.; stylus 8·5 mm. Capsula dilute brunnea, 8 mm. long.

Affinity with *J. Whytei* S. Moore and *J. Melampyrum* S. Moore; from both easily distinguished on sight by the short and broad leaves. From the fistular stem one judges the plant to be an aquatic, but there is no note to support this.

JUSTICIA EXTENSA T. And. Dumu; *Vanderyst*, 4829.

RHINACANTHUS DEWEVREI De Wildem. & Durand (*R. parviflorus* T. And.). Boyeka; *Nannan*, 94. Used for poisoning fish.

R. parviflorus has never been described: it is mentioned as a *nomen nudum* in Bull. Soc. Roy. Bot. Belg. xxxviii. p. 106. There seems no reason to doubt its conspecificity with *R. Dewevrei*, which itself appears distinct from *R. communis* Nees, though Clarke thought otherwise.

Rhinacanthus minimus, sp. nov. *Herba* parva, spithamea vel paullulum ultra; *caule* basi decumbente radicanteque inde ascendente tenui sparsim ramoso puberulo; *foliis* petiolatis ovatis acutis nisi breviter acuminatis basi rotundato-cuneatis nervis pag. inf. puberulis exceptis fere glabris; *fasciculis* paucifloris ad apicem ramorum axillarium floriferorum tenuissimorum minute pubescentium vel iisdem lateraliter affixis sessilibusque; *bracteis* uti bracteolæ angustæ linearibus calyce minoribus; *calycis* segmentis anguste linearibus acutis minute pubescentibus; *corollæ* puberulæ tubo calycem bene excedente ipso sub limbo levissime constricto labio antico late obovato quam posticum ovatum apice emarginatum longiore; *staminibus* breviter exsertis antherarum loc. paullulum inferiori breviter calcarato; *ovario* puberulo in stylum breviter sparsimque strigillosum desinente; *capsula* puberula.

Bokala; *Vanderyst*, 4972.

Folia tenuiter membranacea, in sicco viridia, usque 5 × 3 cm., sed sæpe multo minora; petioli puberuli, foliorum majorum 12–20 mm. long., minorum sæpe modo 4 mm. Florum fasciculi ramis interdum 10 cm. long. etsi interdum insigniter brevioribus insidentes; ramus quisque juxta medium itaque ad apicem fasciculum gerens. Bracteæ bracteolæque summum 2 mm. long. Calyx 5 mm. long., hujus segmenta aliquantulum inæqualia. Corollæ tubus 6·5 mm. long., 1·5 mm. lat.; labium anticum 4 × 3·5 mm.; anticum 2 mm. long. Antherarum loc. sup. ·65 mm. long., loc. inf. (incluso calcari obtuso) ægre 1 mm. long. Ovarium 1·5 mm., stylus 8 mm. long. Capsula 12 mm. long. Semina 4, fusco-brunnea, scrobiculata, 1 mm. diam.

Remarkable for its slender habit and very small flowers together with the ovate leaves.

Rungia congoensis Clarke. Kunzulu; *Vanderyst*, 4497.—R. grandis T. And. Tua; *Vanderyst*, 4974.

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2. Vaupelia A. Brand.

This is a genus proposed (Fedde Rep. xiii. p. 82) for plants till then included in the genus *Trichodesma*, the flowers of which they greatly resemble. The reason for taking this step concerns the position of the carpels upon the receptacle, as everyone knows a fundamental character in the classification of *Borraginaceæ*. The Trichodesmas have carpels with their inner or at least their lower face adnate to the conical or convex gynobase, whereas the gynobase of the Vaupelias is flat, and the carpels are attached to it only by their flat base. On this account Brand suggests the removal of *Vaupelia* from the *Cynoglosseæ* to the *Lithospermeæ*, and in this he seems undoubtedly correct. He also notes the close connection between *Vaupelia* and *Cystistemon* Balf. f. from Socotra.

As thus characterized *Vaupelia* (ranging from Somaliland to Angola) contains six species: 1. *heliocharis* (*T. heliocharis* S. Moore); 2. *hispida* (*T. hispidum* Bak. & C. H. Wright); 3. *Medusa* (*T. Medusa* Bak.); 4. *barbata* (*T. barbatum* Vaupel); 5. *macranthera* (*T. macrantherum* Gürke); 6. *Mechowii* (*T. Mechowii* Vaupel). Only the first three of these are found in the Flora of Trop. Afr. (iv. 2, p. 45), the others, with the exception of *macranthera*, having been published later: in Fl. Trop. Afr. *macranthera* is wrongly merged in *Medusa*, from which it is certainly distinct. The mistake arose through Baum's no. 928 having been distributed from Berlin as "*Trichodesma macranthera* (sic) Gürke, sp. nov.," whereas the type is Dekindt no. 8, unrepresented in this country. The plant can be at once recognized by its short calyx; it is represented at the Museum by *Gossweiler* no. 3837 from Mumua woods at Kakonda.

To the six species mentioned above is now to be added a seventh, namely:

3*. **Vaupelia hispidissima**, sp. nov Frutex ultraorgyalis, *caulibus* simplicibus e rhizomate ascendentibus validis hispidis saltem superne crebro foliosis; *foliis* alternis rigidis sessilibus oblongo-lanceolatis apice mucronatis basi obtusis utrobique pilis strigosis appressis basi conspicue bulbosis creberrime indutis; *inflorescentiis* folia longe excedentibus e cymis scorpioideis pluribus sat longe pedunculatis uti pedicelli calycibus plane longiores fulvide hispidissimis compositis; *bracteis* foliis consimilibus nisi minoribus; *calycis* campanulati hispidissimi segmentis lanceolatis acutis; *corollæ* tubo calyce breviore pentagono glabro lobis tubo duplo longioribus lanceolatis dimidio distali gradatim attenuatis sed haud linearibus apice acutis dorso appresse griseo-pubescentibus; *antheris* quam corollæ lobi paullulum brevioribus superne rectis inferne minute pubescentibus.

Angola, in thickets between old Munonque and U'jaio; *Gossweiler*, 3132. To be referred here are also specimens found by the same collector in grassy open woods of *Berlinia Baumii*, near Kutato, no. 3958.

Caules ex schedis cl. delectoris cæspitosi, usque ad 7 ped. alt., fistulosi etsi lignosi, circa 6 mm. diam. Folia pleraque inf. 6–10 cm. long., juxta medium 13–18 mm. lat.; costa centralis pag. inf. prominens; folia juniora circa 3–4·5 × 1 cm., summa imminuta in bracteas transeuntia. Inflorescentia usque 25 × 13 cm. Cymæ ascendenti-patentes, summum circa 7 cm. long. Pedicelli plerique 15 mm. long. Calyx 12 mm. long.; segmenta basi 3 mm. lat. Corollæ tubus 6 mm. long., basi 3 mm. sub limbo 4 mm. lat.; lobi 14 mm. long., juxta basin 4 mm. lat., apicem versus 1·5 mm. Antheræ 13 mm., stylus 25 mm. long. De fructu sileo.

Differs from *V. Medusa* Brand chiefly in the tall habit, the densely hairy leaves, the much more hispid inflorescences, and the larger flowers on longer pedicels, with larger calyx provided with broader segments and much broader corolla-lobes, which do not run out into a linear prolongation and are finely pubescent upon the back. Among other characters *V. barbata* Brand is entirely different in foliage and corolla.

The flowers would seem to vary in colour, those of no. 3132 Mr. Gossweiler notes as "purplish green throughout," while of no. 3958 he writes, "calyx purplish violet; corolla segments whitish blue outside, brilliant violet-blue inside."

(To be continued.)

CORNELIUS VARLEY
(1781–1873).

By JAMES GROVES, F.L.S.

It is gratifying to be able to include in the roll of British botanists so remarkable a man as Cornelius Varley. A chance reference guided me to his paper "On *Chara vulgaris*," read before the Microscopical Society on the 12th November, 1845, and published in 1849 in vol. ii. (pp. 93–104, tt. 14–21) of that Society's *Transactions.* The paper appears to have escaped notice, as it is not included in the generally comprehensive bibliographies of the group; it was therefore a surprise to me to find in it a work of great merit. It consists of twelve pages of matter with eight coloured plates, containing thirty-four figures, all but one of which are much magnified. In these Varley describes in plain but precise language, and depicts with his pencil in firm vigorous lines, just what he saw under his microscope, with no bias as to what he might be expected to see. It stands out in consequence as a fine original piece of work, and the drawings present a marked contrast to the extraordinarily clumsy and conventional monstrosities which appear in some histological plates of Charophyta of the earlier half of last century.

The accurate manner in which he worked out the structure and development of the stem-cortex in its ascending and descending series is astonishing, and his figures relating to this on tt. 17 and 20 have never been surpassed for clearness and breadth of treatment. The drawings in detail of the various parts of the antheridium and of the oogonium and oospore are also excellent, the little two-storied "cage" at the base of the latter being admirably shown. Though he did not quite appreciate the significance of the pro-embryonic growth, he showed its limited terminal process, and traced the origin of the corticate plant to a bud arising within the pro-embryonic whorl. His drawings of the young plant (t. 15) are very creditable. Varley approached the subject rather as a microscopist than as a botanist, and, although he gives a very fair general account of the structure of the plant, one of the principal objects of both text and figures was to show the result of his observations of the cyclosis or "streaming" in the various parts, in most of which he worked out the direction of the stream in each cell. In estimating the value of Varley's paper, it must be borne in mind that, although not published until 1849, it was read before the Society in 1845, seven years prior to the appearance of Alexander Braun's masterly paper, "Über die Richtung verhaltnisse der Saftströme in den Zellen der Characeen." That a countryman of our own should have made such a successful incursion into a field almost entirely monopolised by foreigners is a matter for congratulation.

The colouring of the plates is unfortunately both crude and incorrect, but for this Varley could not have been responsible. The plant dealt with was evidently *C. delicatula* Braun, not that now generally known as *C. vulgaris.*

This paper appears to be the only purely botanical one which

Varley wrote, but in a much earlier paper on the use of the microscope in vol. 48 of the *Transactions of the Society of Arts* (1831), the structure of, and circulation in, *Chara* was described at considerable length. This paper gives evidence of an immense amount of careful work, and it appears that the author had hundreds of the germinating plants under observation. A number of figures of the various parts of the plant, which in this instance was evidently *C. vulgaris*, accompanied the paper (t. 5. ff. 31–50), and these though rougher and less complete than those of the 1845 paper clearly show many important details of structure. They include drawings of the young plants with the rhizoid nodes and proembryonic whorl, a "branch with a naked base," a section of the oogonium and oospore walls and of the lime-shell, which Varley styles "the seed-skin the shell and the tubular envelope." The lime-shell is aptly described as "quite brittle, something like egg-shell, white and transparent." In the earlier part of the paper, with all the enthusiasm of the expert "glass and brass" man, he enlarges on the construction of the microscope, and the most efficient methods of lighting &c.,.with a view to obtaining the very best optical results. The following volume of the *Transactions*, xlix. ii (1833) pp. 179–194, contained a "Letter from Mr. C. Varley in addition to his Observations on the Circulation in *Chara vulgaris* already published." In vol. l. pp. 159–190, t. 7 (1836), in a paper entitled "Mr. C. Varley on his Vial Microscope," still further information is given as to the Chara, and there is in addition a description and figure of *Nitella tenuissima* from Cambridgeshire under the name of *N. hyalina*, to which species it had then been referred. It is no wonder that these excellent papers and illustrations have escaped general notice, appearing as they do under such unlikely titles. Varley evidently gave a great deal of attention to the construction of apparatus for the continuous examination of living plants and animals. Braun, in his paper already mentioned, refers to Varley as being the first to observe the exit of the antherozoids from the cells of the antheridial filaments.

The following particulars are mostly gleaned from Cosmo Monkhouse's articles in the *Dictionary of National Biography* and Mr. A. T. Story's book, *James Holmes and John Varley*. For the loan of the latter, and for further information, I am indebted to the courtesy of Mr. Percy Varley, a grandson of the subject of this notice.

Cornelius Varley belonged to a particularly gifted family. He was the second son of Richard Varley by his marriage with Hannah Fleetwood, who, there is some reason to believe, was a direct descendant of General Charles Fleetwood by his marriage with Bridget, daughter of Oliver Cromwell. Not much is known of Richard Varley, but, according to Story, he was "a man of some mechanical ability and of considerable scientific attainments." His family consisted of five children, of whom four—John, Cornelius, William Fleetwood, and Elizabeth (who married William Mulready, R.A.)—distinguished themselves as artists. John, the eldest, whom Monkhouse summarises as "landscape painter, art teacher and astrologer" (he might have added mechanician and pugilist!) was a remarkable instance of the combination of genius and eccentricity. A big man of immense physical strength and endurance, in his young days a particularly clever and successful water-colour painter, one of the most successful teachers of art of the day, earning, it is said, in his palmy days over £3000 a year, but generally in money difficulties! Among his pupils were some of the greatest artists of his time; he was the close friend of William Blake and the associate of Bulwer Lytton, Richard Burton, and many other men of mark.

Cornelius was in his uncle's workshop at the age of twelve, and soon showed an extraordinary aptitude for the construction of optical and other philosophical instruments, and at the age of fourteen made himself a microscope, lenses and all. His inventions and improvements in connexion with scientific intruments and appliances were very numerous, and included graphic microscopes and telescopes. He was awarded the Gold Isis Medal of the Society of Arts for his lever microscope for watching the movements of animalculæ, and in 1851 a prize medal for his Graphic Telescope, forty years after its introduction. He contributed a number of articles to the publications of the Society of Arts, mostly in reference to optical instruments.

He was Chairman of the Exhibition of 1851, and lived to be the oldest member of the Society of Arts. Curiously enough, from his early years he had a strong bias in the direction of art, especially water-colour painting. Both he and his brother John were among the founders of the Old Water-Colour Society, the idea of which he is stated to have originated. In its earlier years he contributed a number of landscapes to its exhibitions, but later on sent his pictures to the Royal Academy, where he exhibited up to 1859. He seems to have been equally attracted by the invention and construction of scientific appliances and by landscape painting, the two unlike pursuits taking turn about in absorbing his attention. It is unusual to find an extraordinary aptitude for mechanical science coupled with the æsthetic faculty of the pictorial artist. Both sides of the man are evident in the sketches of *Chara*, the firm sure hand of the mechanical draughtsman coupled with the artistic touch which distinguishes them from almost all other histological drawings of these plants.

A trait of Varley's personal character is disclosed by the following passage from Mr. Story's book:—" . . . In 1822 he accepted the appointment of governor of some mines in Brazil, a very lucrative appointment, and everything was arranged for his voyage; but on discovering that slaves were to be employed on the estates he at once threw up the engagement, an act thoroughly characteristic of the man, and illustrative of the intense aversion he had all through life to any kind of tyranny whether physical or moral." Though more evenly-balanced and methodical than his brother John, he was apparently none too practical in the affairs of everyday life, since some of his family believed and rather resented that Dickens had drawn from him the character of Harold Skimpole in *Bleak House*! He died in 1873 in his 92nd year.

Three of his sons were well-known electrical engineers and inventors, and one of them, Cromwell Fleetwood Varley, was concerned in the design of the first Atlantic cable. Another son, Samuel Arthur Varley (now in his eighty-eighth year), was, I understand, the discoverer of the Dynamo, and the first person to construct a self-exciting dynamic machine, independent discoveries of the same principle being made very shortly afterwards by Sir Charles Wheatstone and Professor Siemens respectively.

WAYFARING NOTES FROM GREAT NAMAQUALAND.

By R. F. Rand, M.D., late Lt.-Colonel S.A.M.C.

(Continued from Journ. Bot. 1912, 60.)

Namaqualand, Damaraland, Ovampoland, were familiar names to the men of the earlier Victorian days. All are now comprised within the South-West African Protectorate, for the government of which the Union of S. Africa has now accepted the mandate.

To-day, travelling by rail and crossing the Orange River at Upington, one can in a day or two traverse country which took the old explorers weeks, and even months, of effort to accomplish. Uncertain rainfall and scarcity of water by the way were the great deterrents. The writer's visit was in early October 1919, and only a few days were available. Windhuk was the furthest point reached to the north. Thereafter a visit was paid to Lüdentzbucht (Angra Pequena). Travelling by rail from the Orange River, right up to Windhuk, one rarely catches sight of running water; sand-river beds there are in plenty. Much of the country resembles the Cape Karroo. The surface may be rocky, stony, or sandy; sometimes it is bare, sometimes dotted over with isolated patches of bush, tufts of grass, and here and there a tree. It is the home of the xerophyte. Succulent forms are many. Patches of desolate country are occupied by the "milk-bush," a leafless *Euphorbia* which grows in isolated clumps like a large rush, with stalks the thickness of a raspberry-cane. It is a social plant of exclusive habits, thriving where little else can. Upon the mountain sides and upon the level, species of *Aloe* are to be seen: *A. dichotoma* very conspicuously. At a wayside halt, Kalkrand, species of the following were seen in flower—*Lycium*, *Blepharis*, *Leptosimum*, *Helichrysum*, and others, with a woody *Asparagus* of straggling habit. From the train window one frequently saw dwarfed and woody undershrubs, and ericoid types were common.

In a stony sandy desert, vegetation is hard put to it to live. The desert-plant has to resist drought, to resist the hunger and thirst of wandering buck or bird, and to resist the wind—usually a strong wind greedy of moisture. Hence the herbaceous and shrubby plants run to flesh, thorn, and wood, and indulge in leaves very sparingly. Vegetation clings to the river-bed and its near neighbourhood: in the Protectorate it is mostly a sand-river bed, where, at varying depths beneath the surface of the sand, water may be trickling. Sand and grit are the normal occupants of the channel, visible running water is only occasionally seen, upon the rare coming of flood. In such a river as the Great Fish River, at Seeheim, the river has cut itself a cañon-like path through horizontally-bedded rocks. The gorge is wide, one hundred yards and upwards; the floor is occupied by sand, with occasional protrusion of rock; the water, when it flows, may course from side to side in lateral channel. Trees of considerable size grow in the sand-bed out of reach of the ordinary flood-water. Such trees take chances and may be overthrown in times of exceptional flood: in the gorge they find water and shelter and the risk is incurred. Many of these trees are Acacias, but there are others the writer could not identify. One, a considerable shrub, showed an interesting feature. It had yellow flowers, about an inch in diameter; surrounding the superior ovary was a growth of white silk hair, enclosed within a membranous bladder-like envelope. After fertilization this envelope ruptures, the hairs develop in size and strength, become brownish in colour, forming regular rows upon the surface of the ovary, and serve to disperse the wind-borne fruit. Round about Seeheim, *Gomphocarpus fruticosus* grew in profusion. This Asclepiad is a pestilent weed and overruns many parts of Africa.

The sand-river varies very much, according to the type of country in which it occurs, and we find its facies varying with the slope. If the declivity be small and the valley wide, the sand-river spreads itself out over a wide area. Charged with water, the sand, in time of flood, becomes mobile, be the fall ever so slight; but upon a considerable slope it does not, when dry, lose all mobility. In areas occupied by ancient crystalline rocks, where the rainfall is a negligible quantity, one may see a sand-river system very well. Small sand-streams course down the higher tributary valleys, join up with others, and finally discharge themselves into the sand-river bed of the main valley. This may be confined within definite banks of rock, but, if the slope be slight, pools and lakes of sand—if the terms be admissible—are formed. A wide flat valley may be filled with such a lake of sand, which at the margins may creep up the sides of the enclosing hills like water up the sides of a burette.

The sand-river system in a mountainous area is comparable to a glacier-system. The sand-river is always there; water may be but rarely present, but some tree with deeply-striking roots may tell of underground supply.

Many of the plants one sees are the despair of the collector; they cannot be made to lie decorously between sheets of botanical drying-paper. The fleshy types have been so well protected by nature against drying that it is difficult to preserve them in a way that will give any idea of the plant in its normal surroundings. Take *Sarcocaulon*, two species of which were seen in flower; it is one of the hardiest of the desert plants. One species had pink flowers; the other one seen had flowers of pale yellow. The fleshy stem bristles with formidable spines. In full bloom it is a beautiful vision, and only sketch or photograph could picture it. A flowering-plant in the desert is a precious thing, for a plant speaks of life and comradeship, as Mungo Park, the well-beloved, found in the long ago.

Near Lüdentzbucht (Angra Pequena), amid crevices of the rock and close to the sea, two species of *Pelargonium* were seen in flower, as also three species of *Mesembryanthemum*; all succulents. Several flowering Composites were also seen and two small species of *Euphorbia*. This in early October, 1919; but in April 1915, during the campaign, the writer saw many more.

No arborescent forms were seen near the coast (Angra Pequena), the plants seen were all herbaceous, and usually fleshy. It is not until one has proceeded some miles inland, and the country has risen 1000 feet and more that larger forms appear. Probably the high winds which sweep the littoral are responsible for this. In dry desert regions the wind is a potent agent and determines many forms, even that of earth itself.

SHORT NOTES.

Newspaper Botany. As a rule one disregards the semi-scientific effusions in the newspapers, but I cannot allow the following, which appeared in the *Daily Telegraph* of the 14th January, to pass without protest, especially as it emanates from a Fellow of the Linnean Society. In an article headed "Noxious Weeds," Mr. Donald McDonald makes the following extraordinary statement:—"There is a weedy grass which in recent years has established itself on the confines of Poole Harbour. It bears the name of *Spartina Townshendii* [sic] and is supposed to have found its way across the Atlantic." It is difficult to imagine the mental outlook of a man who could describe *Spartina Townsendii* as "a weedy grass," particularly for one who, like myself, has the privilege of seeing the glorious stretches of golden brown—the beauty of which in the sunshine it would be impossible to exaggerate—that it forms in autumn and winter at the mouths of our Hampshire and Isle of Wight rivers. To speak of the plant as a "noxious weed" is a gross libel, considering that it has been found of immense service in fixing the loose mud-banks in the estuaries of our southern rivers, and has been planted for the purpose in several localities to which it had not naturally found its way, thus fulfilling a rôle analogous to that of the Marram in relation to the sand-hills. From Mr. McDonald's remark one would suppose that the plant had originated in this country at Poole Harbour. Is it possible that he has entirely missed the various papers by Dr. Otto Stapf and others, in which the almost certainly hybrid origin of the plant, its utility, and its progressive distribution have been demonstrated? James Groves.

[Mr. Groves's entirely justifiable protest omits reference to the fact that he and his brother were the original describers of *Spartina Townsendii* in the *Report of the Botanical Exchange Club* for 1880 (reproduced in Journ. Bot. 1881, 347); a fuller description by them, with an excellent plate by Mr. Henry Groves, appeared in Journ. Bot. 1882 (p. 1, t. 225).—Ed. Journ. Bot.]

Sex-terms for Plants. I should like to add a few words to my note on this subject in last year's *Journal* (p. 285). It seems to me that if an author, for the purpose he has in hand, desires to go beyond the familiar and convenient terms "male" and "female," in order to particularise the two kinds of individuals met with in diœcious "Seed-plants" (in which the two generations are combined), as distinguished from the two kinds of gametophytes met with in some of the Cryptogams, he requires for this purpose two new terms denoting "male-element-bearing" and "female-element-bearing." The use of a "macro" and "micro" set of terms as suggested by Dr. Church is, I submit, open to objection, inasmuch as relative size is incidental, and the really important distinctive element of sex is ignored in them. The codification of botanical terminology seems a crying necessity. One rarely nowadays reads a book or extensive paper, dealing with original work, which does not contain some new term or some existing term used in a specialized sense; and it is not unusual to find the same term applied differently by different authors. It is quite impossible for Dr. Jackson or any other man to keep pace with this constantly-growing vocabulary; moreover, a glossary alone does not meet the need. One realizes that such a codification is a herculean task, but I think some attempt might be made to deal with it in sections at future International Botanical Congresses. It is, I suppose, only natural for anyone engaged on a special line of research, when he cannot find an existing term which exactly fits the needs of the moment, to coin a fresh one; but the result of such action has been to build up an enormous and unwieldy mass of terminology and to hedge the science round with unnecessary difficulties.— JAMES GROVES.

JUNCUS PYGMÆUS Rich. In the *Journal* for September last (p. 260), I reported a new Cornish locality for this plant. Being previously unacquainted with the plant, I referred my specimens to an eminent critical botanist, now deceased: his reply was, "Your Rush is *Juncus pygmæus*." Further examination by other botanists has shown that the specimens are really *J. capitatus* Weigel, in a rather stunted state. I believe my deceased friend would have corrected his own diagnosis, had he lived; as matters are, it remains for me to do so, at the same time regretting that an error should have found its way into print.—H. DOWNES.

REVIEWS.

Dr. John Fothergill and his Friends: Chapters in Eighteenth Century Life. By R. HINGSTON FOX, M.D. 8vo, pp. xxiv, 434, with 13 plates: price 21*s*. net. Macmillan.

IN this well-printed and scholarly volume, Dr. Hingston Fox has made an important contribution alike to the history of botany and to that of the period to which it relates. From the latter standpoint the book has received a duly appreciative notice in the *Times Literary Supplement* and elsewhere: our own remarks must for the most part be restricted to its former aspect.

The main facts of Fothergill's life are sufficiently well known.

Born in Yorkshire in 1712, he graduated M.D. at Edinburgh in 1736 and in 1740 settled in London, as a physician, where he died in 1780: his "public repute during the latter years of his practice throughout Great Britain and Ireland, in some parts of Europe and in the North American colonies and the East and West Indies was probably greater than that of any other London physician." Dr. Fox has not only embodied in his book the not inconsiderable amount of material already published relating to Fothergill, but has supplemented it by an abundance of information derived from various sources, including MSS. in the Botanical Department and at the Royal and Linnean Societies, and by others in the possession of the Society of Friends, to which body Fothergill belonged, and of the Fothergill family. One of the most noteworthy features of the volume is the completeness of its references and footnotes, the latter containing much information relating to persons incidentally mentioned and evincing minute and careful research.

Fothergill's interest in botany is associated with his celebrated garden at Upton; to this Dr. Fox devotes a chapter, wherein he traces its history and describes its present condition: it now constitutes West Ham Park—"an open space of 80 acres, surrounded by the teeming population of this eastern suburb." Fothergill bought the estate, which he afterwards enlarged, in 1762: a letter from him to Linnæus in the Linnean Society's Library, written in 1774 in Latin, translated by Dr. Fox, shows that the suggestion was due to Collinson, who "urged me to form a garden, himself giving me many things; and opportunity favoured the collection of others. Thus has come into being a paradise of plants of small extent, whose master, if slenderly furnished with botanical science, has at least a burning love of botany itself" (p. 183). The garden thus modestly described was regarded by those who knew it far more appreciatively: according to Banks, with the exception of Kew "no other garden in Europe, royal or of a subject, had nearly so many scarce and valuable plants." On this subject Banks was well qualified to speak: we have in the Botanical Department the "Day-book" from 1777 to 1797 of the Banksian collections, which were at that period the chief source of botanical information for horticulturists. In this book are determinations—mostly in the writing of Solander or Dryander, but with occasional entries by Banks—of plants sent from Kew and other gardens to be named: among these the lists of plants from Fothergill's garden occupy twelve pages, ranging from May 1777 to 1780, the year of his death. There are notes on many of the species by the botanists mentioned and several are indicated as new; some of these are described in the Solander MSS. and were subsequently published in Aiton's *Hortus Kewensis*. The specimens from Fothergill in the National Herbarium to which Dr. Fox refers (p. 199) were for the most part sent from the Upton garden for the purpose of naming; many are types for the descriptions in *Hortus Kewensis*—a list of the plants from Fothergill therein and elsewhere described is given by Dr. Fox (pp. 203–7).

With characteristic energy, Fothergill took every opportunity of enriching his garden—by correspondence at home and abroad, by the aid of sea-captains and travellers, and by the employment of collectors, among whom were Archibald Menzies, then a young man of twenty-one, William Brass, Henry Smeathman, and various Americans, including the Bartrams and Humphry Marshall. The garden was especially rich in North American plants; a letter from Fothergill to the last-named (quoted on p. 194) gives some account of these: "it is acknowledged by our ablest botanists that there is not a richer bit of ground, in curious American plants, in Great Britain."

The history of some of the more interesting plants is given in detail (pp. 195–197)—*e. g.* the Tea-plant, Ginseng, *Illicium floridanum*, and *Arbutus Andrachne*. The last, as Dr. Fox states, was the subject of a paper by Ehret in Phil. Trans. lvii. 124 (1767); this is accompanied by an excellent plate, the sketch for which is among the large collection of Ehret's drawings in the Department of Botany (no. 93 *a*). The tree was grown from seeds sent to Fothergill from Aleppo by Alexander Russell in 1754, who also forwarded a specimen of which Ehret made the drawing (no. 93 *b*), whence the dissections on the published plate were taken. Curiously enough, the *Arbutus* does not appear in the list of plants in Russell's *Natural History of Aleppo*, nor is there a specimen from him in the National Herbarium, which contains so many of his plants.

Among the trees which still remain from Fothergill's time, Dr. Fox mentions (p. 200) "an ancient *Euonymus*"—this we understand is really *Rhamnus catharticus*: one or two slips on this and the following page—*e. g.* "gingko" and *cyrenaica* (for *pyrenaica*) suggest that Dr. Fox is not altogether familiar with botany—an impression confirmed by the note (p. 191) that *Lantana Bartramii* Baldwin is "akin to *Viburnum*" a mistake doubtless arising from the name *Viburnum Lantana*. If this be so, great credit is due to the author for the general accuracy of his botanical references. The Bartram commemorated by Baldwin (cfr. *Reliquiæ Baldwinianæ*, p. 24) was, as its author expressly states, John—not William, as suggested by Dr. Fox,—and the same correction applies to Salisbury's genus *Bartramia*, referred to in the same note. It may be said here that mistakes of any kind are astonishingly few and those of but little importance: for example, Fothergill's house (16 Harpur Street, W.C.) is not "now"—and indeed never was—"occupied by a Benedictine brotherhood," although Abbot (now Cardinal) Gasquet and another monk lived there before the departure of the former for Rome.

Among the Friends—in both senses of the word—due prominence is given to Peter Collinson (1694–1768) to whom frequent reference has been made in these pages, and to John Bartram (1699–1777); the chapter devoted to these two men, of whose activities an admirable summary is given, is among the most interesting in the book. We gather from the two last of the seven letters from Bartram to Fothergill (1769–71) preserved in the Botanical Department—these have not been printed, but will appear in the work on Bartram that we are expecting from Miss Carlotta Herring-Browne—that the relations between them may have become strained: in the last (May 19, 1771) Bartram complains of Fothergill's silence, to which he had already referred in the letter of the previous September, "which inclines me to conjecture he has taken some afront which if he hath I am intirely inocent & ignorant which way & he should candidly & friendly advertised me thereof." With Collinson Fothergill's personal relations, which began about 1740, were for many years of the most cordial nature, as is shown in the "Account" published anonymously two years after his death as "a Letter to a Friend": in this it is noted that Collinson had "a vast treasure of dried specimens of plants," of whose subsequent history we have no trace.

As we said at the beginning of this notice, our remarks must be mainly confined to the botanical interest of the book; but this forms only a portion, and that not the largest portion, of its contents. We have indeed seldom met with a volume which, while never unduly discursive, appeals to so many various interests: the members of Dr. Fox's own profession will appreciate the chapters which deal with Fothergill's work as a physician and with his medical friends—some, *e. g.* Lettsom, themselves connected with botany; historians will like the chapters which deal with Fothergill's intimate relations with America, both before and after the War of Independence, and with Benjamin Franklin; the chapters relating to the Society of Friends, especially that on Acworth School, should interest a wider circle than the members of that body; those on his pioneer work as a philanthropist and social reformer and on his other scientific interests afford evidence of Fothergill's energy and breadth of view: there is an account also of "Home Life in London" from the MS. journal from the diary of a niece who visited Fothergill in Harpur Street in 1769–70. The book, which has portraits and other illustrations, ends with a careful and sympathetic appreciation of Fothergill's character; and there is of course an excellent index, from which however the Upton garden is omitted.

Thalassiophyta and the Subaerial Transmigration. By A. H. Church, M.A. Botanical Memoirs. No. 3. Oxford University Press, 1919. 95 pp. Price 3*s.* 6*d.* net.

In this remarkable treatise Dr. Church expresses his views as to the marine origin of all land vegetation. In a previous memoir—*The Building of an Autotrophic Flagellate* (noticed in this Journal for 1919, p. 288)—he prepared the way by showing that Life itself must have originated solely from the ions of sea-water, and he indicated the inevitable steps by which the resultant unicellular organisms of the Plankton Epoch were developed and acquired those fixed cytological characters which all subsequent cells have inherited. Autotrophic plant-cells those early organisms mostly were; but with them were associated animal derivatives. In the present memoir the story is carried forward; and it is shown how after long ages, when the ever-rising sea-bottom had become elevated to within a hundred fathoms of the surface of the all-enveloping ocean, and thus had afforded a safe and convenient anchorage to both plants and animals to settle on, the second or Benthic Epoch began. And now for the first time multicellular sessile algæ (and animals) came into being and elaborated those morphological and anatomical characters which we find in marine algæ of the present time—*e. g.*, filamentous or parenchymatous fronds, all sorts of ramification, leaf-like ramuli, shrubby habit, apical and meristematic growth, haptera, mucilage hairs, reproductive organs in great variety, alternating generations, sporangia, &c.—in fact, all the normal equipment of marine phytobenthon. After further ages the sea-bottom gradually came right up to the surface, exposing whole continents of benthic life to the severe ordeal of an aerial environment. Thus began the Epoch of the Land Flora; and any algæ that failed to adapt themselves to the novel and exacting conditions perished miserably. The severity of the struggle was mercifully tempered by the exceeding slowness of the changes by the daily tides, and by the newly acquired advantages of a vastly increased supply of sunshine and oxygen. The chief problems to be met were the risk of desiccation, the loss of food-salts, the need of a stiffening endoskeleton, as well as the adaptation of the organs and modes of reproduction to meet the requirements of the new aerial conditions, and the modification of the spore-mechanism to secure aerial dispersal. Dr. Church has much to tell us about these matters—such as the production of roots, the origin of the transpiration current and of stomata, the polyphyletic elaboration of that successful adaptation the archegonium, the apparent decadence but really efficient economy of the gametophyte, the spore-wastage of the Fern, heterospory, &c.

It was the Green Algæ only that succeeded in gaining a footing on the dry land, and of these only the highest types survived; but so completely altered have they become in shape, structure, physiology, and reproduction, that their algal ancestry is now untraceable. We have distinct phyla of Bryophyta, Lycopods, Equisetaceæ, Ferns, Gymnosperms, Angiosperms, &c. (The antherozoids of the Lycopods and Ferns indicate that the cleavage between these two phyla reaches back to the Plankton Epoch.) Two other interesting groups that date from the same period of land-emergence are the Characeæ and the Fungi. To the latter a long and instructive chapter is devoted pointing out their markedly polyphyletic origin (*e. g.* Phycomycetes, Ascomycetes, Basidiomycetes, Uredineæ) from algæ which held their own by reason of adopting a saprophytic or parasitic life, and by elaborating resting-spores, air-borne spores, &c., which withstand drought and ensure a wide dispersal. No trace of the highly organized green algæ of the transmigration is ever likely to be found in geologic strata, since they were earlier than the sedimentary rocks. They developed into land-plants and left no trace in the ocean. Brown and Red Algæ, however, were unfitted to benefit by the transmigration, the brown being inadequately developed in reproductive mechanism, the red in vegetative structure. They are with us still and are little altered. That the transmigrant land-flora should seem so unconformable with modern marine algæ is no more surprising than that the land-mammals are unlike the fish.

The above sketch briefly indicates the scope and importance of Dr. Church's memoir and the originality of his views. No such clear-sighted and thoughtful contribution to the study of plant-evolution has ever before been achieved. Incidentally it shows that the answer to such fundamental questions as—why are plants composed of cells? or, why is their reproductive mechanism so complex?—must be sought in the sea. "The beginnings of Botany are in the sea"; and the equipment of the land-plant is necessarily inherited from its marine ancestors. No student or school of botany can afford to neglect or overlook this illuminating contribution to a much debated branch of natural science.

Dr. Church's writings constitute a new era in the study of botany. It is perhaps to be regretted that his hypotheses are presented in so condensed a style; the reading demands sustained effort to follow the close reasoning and to retain and grasp the logical conclusions. Dr. Church has laid the botanical world under a great obligation; and it is with the greatest interest that we look forward to further publications by so inspiring and suggestive a writer. A. G.

BOOK-NOTES, NEWS, ETC.

THREE recent contributions (1919) to the *Journal of the College of Science* of the Imperial University of Tokyo reach us for notice: all are written in German and are suitably illustrated.—In Researches on Water-Absorption by Cut Branches (xliii. 2), Taneyoshi Matsushima emphasizes the fact that diminution of absorptive activity is insignificant in plants with abundant woody parts, but very considerable in forms with latex, mucilage, or resin-secreting tissues. In the latter case burning the cut ends assists water-absorption. The presence of acids, especially organic (·1 to 1 °/₀), normally increases the capacity, alkalies depress it; but the converse holds for the forms with mucilage, resin, etc.

In Œcological Studies on the Vegetation of the Ota Dunes (xliii. 3), Yoshiji Yoshii gives a general account of this dune of the Pacific Coast, between a River Toné and the Kashima Sea, and its special flora. Characteristic vegetation ranges from Dune forest of *Pinus Thunbergii* to bushes of *Juniperus rigidus* and *Eleagnus fragrans.* The tops of the sand-hill include special types, as *Carex macrocephala*, *C. pumila*, *Phellopterus littoralis*, *Ischæmum anthephoroides* and *I. muticum.* On the sandy beach *Wedelia prostrata* is conspicuous, with *Calystegia Soldanella*; these types are discussed in detail. *Carex macrocephala* is the first colonist of moving sand, with rhizome-system spreading a foot beneath the surface at 6–10 ft. a year, and is an essential factor in dune-building; vertical rhizomes thrusting upwards raise the level at 6–14 inches a year. *Ischæmum anthephoroides* forms tussocks in the sand, and *Phellopterus littoralis* is also effective in binding the surface.

Yoshinari Kuwada continues observations on the chromosome-number of *Zea Mays* (xxxiv. 10). The haploid number, as seen in meiosis of pollen-development varies from 10–12, and the diploid number (in root-apices) from 20–24, in various cultivated races as Sugar-corn, Black Starch, Amber Rice Pop-corn, Black Mexican.

Hybrids between these races show a varying number of gemini, not always constant for the same type. From the fact that other presumably older races as Chinese Maize, Pod-Maize, and *Euchlæna mexicana* all show 10 gemini, it is concluded that 10 is the original number (as also in *Andropogon Sorghum*), and variations are due to mutations and possibly hybridization with some hypothetical form of *Andropogon*, as suggested on slender evidence by Collins (1912). Evidence in support of this view is obtained by measurement of the chromosomes, as long and short; the longer ones being referred to *Euchlæna*, the shorter to *Andropogon*. Subdivision of either 1 or 2 special chromosomes of the *Euchlæna*-type is supposed to be responsible for the additional units, with variants dominant in the hybrid forms. Considerable space is devoted to working out schemes for suggested unions to account for the peculiarities of the hybrids of the above-mentioned varieties. In view of the interest attaching to the evolution of strains of *Zea Mays* in America, and recent condition of affairs, it is a matter of regret that the paper should have been written in German.

Mr. Oliver Atkins Farwell sends us from time to time extracts from various American sources, often pharmaceutical, the chief object of which appears to be the formation of new combinations. We have more than once protested against this perverted form of industry, which can only result in the addition of new and still-born names to our already overburdened nomenclature. To take two examples: Mr. Farwell (in *Druggists' Circular*, N. York, lxiii. 50) says that "the correct name" of the plant universally known as *Premna taitensis* Schauer is "*P. arborea* (Forst. f.) N. Comb." (the capitals, always employed, are of the original note). George Forster's name—*Scrophularioides arborea*—is a nomen nudum and has never been quoted except in synonymy, so Mr. Farwell's "correct name" has not the slightest claim to recognition.

On the preceding page Mr. Farwell proposes to restore Bruce's *Cusso* for *Hagenia abyssinica* (=*Brayera anthelmintica*): had he referred to Bruce's book instead of taking the reference from the Kew *Index*—the facile source of many literary rather than botanical combinations—he would have seen that, far from intending Cusso to be regarded as generic, Bruce actually bestowed a Latin name on the plant—the plate is lettered "Cusso or *Banksia Abyssinica*," and the latter name appears also in the text (p. 73), although neither Ind. Kew. nor Mr. Farwell quote this. In this case, however, Mr. Farwell, had he carried his investigations a little farther, might really have secured a "N. Comb."; for *abyssinica* is certainly the oldest name for the species, and it is open to the next writer on *Brayera* to restore it, though we have no intention of doing so. If it were desirable to continue this criticism, Mr. Farwell supplies abundant material; but enough has been said to show that his "correct names" and "N. Comb." must not be accepted without investigation. It may be noted that his adoption of *Veronica persica* as the correct name for that species (Rhodora, xxi. 101: May, 1919) was anticipated by Mr. Lacaita on firmer ground in this Journal for Feb. 1918, p. 55.

That the protest given above as to new combinations resulting only from literature is not without justification is shown by the following extract from a recent paper by Mr. J. F. Macbride (Contrib. Gray Herbarium, no. lix. p. 33: Sept. 1919):—"Mr. G. Claridge Druce, Bot. Exch. Club, v. 38 (1918), has reduced the genus *Allocarya* to *Lappula*. It is to be regretted that he has not given the reasons which induced him to make this, to say the least, striking reduction, for the genera *Allocarya* and *Lappula* are even more distinct than *Eritrichium* and *Lappula*, genera universally accepted. It seems almost inconceivable that Mr. Druce had a specimen of *Allocarya* before him at the time he referred it to *Lappula* (*L. stipitata* (Greene) Druce, *l. c.*). Rather does it seem probable that the plant collected as a waif in England was, in fact, one of the annual species of *Lappula*, although the fact that the determination was made by Dr. Thelling decidedly weakens that theory."

The *Kew Bulletin* (no. 10, 1919) contains an account of the arrangements made for the Botanical Survey of the Union of South Africa, to which Miss A. G. Corbishley, B.A., of the University of South Africa, has been appointed assistant at Kew. Mr. W. B. Turrill has a revision of *Mendoncia*, which now includes twenty-five species, whereof five are new, and Mr. W. B. Grove continues his enumeration of species placed by Saccardo in the genus *Phoma*.

The *Annals of Botany* (January) contains a long paper by B. Muriel Bristol "On the Algal-Flora of some desiccated English Soils: an important Factor in Soil Biology"; there are descriptive notes, with figures, of the nineteen species found, two of which—*Chlamydomonas pluristigma* and *Gongrosira terricola* are new. Dr. Salisbury writes on "Variation in *Anemone apennina* and *Clematis Vitalba*, with special reference to Trimery and Abortion"—a continuation of his observations on *Eranthis* and *Ficaria* published last year in the *Annals*. Dorothy Bexon discusses "The Anatomy of some Polycotylous Seedlings of *Centranthus ruber*": and B. Salmi, Professor of Botany at Benares, writes on "Certain Archaic Features in the Seed of *Taxus baccata*, with Remarks on the Antiquity of the *Taxineæ*."

The *Transactions and Proceedings of the Botanical Society of Edinburgh* (vol. xxvii. pt. 4)—which, like the Kew *Bulletin* and several other important publications, makes no use of its page-headings—contains papers by Mr. Arthur Bennett on *Calamagrostis stricta* and *C. strigosa* and on the Flora of Caithness, with notes on Hagström's "Critical Researches on *Potamogeton*," excluding the British species which were discussed in this Journal for 1919 (pp. 10–20), and a note on *P. longifolius* Gay. Captain W. B. Gourlay writes at length on *Vaccinium intermedium* Ruthe, on which, with Captain G. M. Vevers, he contributed to the same volume of the Journal an account (p. 259) to which no reference is made. Mr. W. W. Smith establishes a new genus of *Gesneraceæ*—*Whytockia*, commemorating the President of the Botanical Society—for *Stauranthera chiritæflora* Oliv., and there are obituaries of Dr. R. C. Davie and W. B. Boyd.

The Rev. Ethelbert Blatter, S.J., is publishing in the *Records of the Botanical Survey of India* (Government Press, Calcutta) a *Flora Arabica*, on the lines of his *Flora of Aden* which appeared in the same periodical: the first part (*Records*, vol. viii. no. 1) contains the orders *Ranunculaceæ* to *Moringaceæ*. The synonymy and distribution are very fully given; there are no new species, but a few new varieties of well-known plants, as well as new combinations, rendered necessary by the reduction of genera—two in *Balanites* and two in *Vitis*. We are sorry to note that the usefulness of page-headings is ignored as is too frequently the case; "Records" &c. on the left hand and "Flora Arabica" on the right occupy throughout space which might profitably be filled by the name of the order and genus under consideration, after the fashion of all the best floras.

The *Bulletin de la Société Royale de Botanique de Belgique* (liii.), which, dated 1914, has but lately come to hand, contains a full biography by E. Marchal of Théophile Durand (1855–1912), with portrait and bibliography.

The *New Phytologist* (xviii. no. 8; Dec. 4, 1919) contains a paper by Dr. A. H. Church on "The Ionic Phase of the Sea" and "Observations on the Perianth in *Ranunculus auricomus* and *Anemone coronaria*" by W. B. Turrill.

The Report of the Watson Botanical Exchange Club for 1918–19 has been unavoidably delayed; it is proposed to issue this with the Report for 1919–20 early in the present year. Mr. J. E. Little will be the distributor.

As a slight expression of sympathy with M. Cardot, of Charleville, in his losses through the occupation and destruction of most of his possessions by the Germans during the War (see Journ. Bot. 1914, 313), a fund is being raised to enable the Paris Museum of Natural History to purchase his herbarium of Mosses, practically the only part of his belongings that remains intact. The herbarium is a very valuable one, containing the types of many new species and the material on which is based his numerous and well-known bryological treatises. It is M. Cardot's great desire that the herbarium shall become the property of the French nation, but unfortunately with his present restricted means he is not in a position to make a gift of it, while the funds at the command of the Museum authorities scarcely permit of its purchase at what would be an adequate value. The Museum authorities have, however, agreed to find half the price agreed on—a price of 10,000 f. has been arranged—if the remaining half can be raised among friends and sympathisers. Botanical friends in the U.S.A. are undertaking to raise half of the balance, leaving the sum of 2500 f. to be found here. This at the present rate of exchange would entail a sum of between £60 and £70. Contributions towards this fund will be gratefully received by Mr. H. N. Dixon, 17 St. Matthew's Parade, Northampton, who is acting as Treasurer of the fund.

"JOURNAL OF BOTANY" REPRINTS.

In view of the fact that the stock of these is in some cases practically exhausted, the attention of our readers is directed to the list which appears on the following page. Old subscribers of course already possess the matter contained in them in the pages of the *Journal*; but some of them appeared several years ago, and recent subscribers will thus not possess them. Some, which do not appear in the list, are already out of print; of others very few copies remain, and it will of course be impossible to reprint them: among the latter may be mentioned Mr. Jameson's *Genera and Species of British Mosses*, Mr. Riddelsdell's *Flora of Glamorganshire*, Mr. Dallman's *Notes on the Flora of Denbighshire* (1911), and Mr. Bennett's *Supplement to 'Topographical Botany.'* Of the Supplements to the *Biographical Index* no complete sets remain. It had been hoped before this to issue the second edition of the work, in which these Supplements are of course incorporated, but the present cost of paper and labour has rendered this impossible. Of the *Index* itself no copies remain, these having been lost in the course of transferring the stock to Messrs. Adlard. Mr. Garry's *Notes on the Drawings of Sowerby's 'English Botany,'* containing, as it does, much topographical information and numerous unpublished notes by Smith, Sowerby and others, should be in the possession of all interested in the history of British Botany: only sixteen copies remain.

It may be pointed out that, although for the most part relating to British Botany, certain of the reprints have a more general appeal. Such are the *Index Abecedarius*—a list of the plants in the first edition of Linnæus's *Species Plantarum*, showing at a glance what are included in that work, which has no index of species; the *History of Aiton's 'Hortus Kewensis,'* which contains much information as to the authors and contents of that classical work; the *Flora of Gibraltar*, which, besides a complete list, contains notes on the more interesting species; Linnæus's *Flora Anglica*—the first English Flora—has a bearing upon nomenclature: of all these there are numerous copies.

[*Over.*

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No. 687 MARCH, 1920 Vol. LVIII

THE JOURNAL OF BOTANY

BRITISH AND FOREIGN

EDITED BY

JAMES BRITTEN, K.C.S.G., F.L.S.

LATE SENIOR ASSISTANT, DEPARTMENT OF BOTANY, BRITISH MUSEUM.

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The Journal of Botany was established in 1863 by Seemann. In 1872 the editorship was assumed by Dr. Henry Trimen, who, assisted during part of the time by Mr. J. G. Baker and Mr. Spencer Moore, carried it on until the end of 1879, when he left England for Ceylon. Since then it has been in the hands of the present Editor.

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ROYA ANGLICA G. S. WEST, A NEW DESMID;

WITH AN EMENDED DESCRIPTION OF THE GENUS *ROYA*.

BY WILLIAM J. HODGETTS, M.Sc.

THIS new species of *Roya* was found in early April 1916 in some very shallow water in the swampy corner of a meadow at Quinton, near Birmingham. It occurred in practically a pure growth (the only other Algæ present being a few Diatoms) which formed soft gelatinous pale-green masses, floating on the surface of the water. Countless numbers of vegetative cells, many of them in process of conjugation, were present, while zygospores occurred in thousands. The Alga as soon as found was submitted to the late Prof. G. S. West, who pronounced it to be a new and very interesting species of *Roya*: one, moreover, which made necessary some modification of the characters on which this genus is founded. Prof. West made drawings of the Alga—which he named *Roya anglica*—and was to have published an account of it in the "Algological Notes" which he was contributing to this Journal; but his untimely death prevented this from being carried out. The drawings have been placed in the hands of the present writer, and it seems desirable that a short description of the species should be published. Unfortunately, the Alga quickly disappeared from its original locality and has never been observed since, except very occasionally as isolated cells in water from the corner of the same meadow.

The facts concerning this Alga have been taken from some notes and drawings made in 1916 and from characters observed in some permanent preparations, and from Prof. West's drawings.

The form of the vegetative cell is cylindrical or subcylindrical, unconstricted, and very slightly tapering towards the extremities, the latter being subtruncate (A–D). The cells are sometimes quite straight but generally somewhat asymmetric, a slight but never regular curvature being present, especially in the longer cells, while the greatest width of the cell is often not in the middle but nearer to one end than the other (see A); in extreme cases the shape is almost clavate. The size varies considerably, the length being 35–80 (–112) μ, the greatest width 7·5–9 μ; the ends are 5–7 μ wide. The cell-wall is colourless and quite smooth, of moderate and uniform thickness, except at the ends of the cell where it is somewhat thicker than elsewhere (A–D). It is impossible to distinguish the line of demarcation between old and new semi-cells, but the younger end of the cell can often be determined by the fact that the thickening of the extremity of the cell-wall at this end is frequently less pronounced than it is at the older end.

Neither in the unstained condition nor after staining with gentian-violet could any signs of pores or of any other structure be observed in the cell-wall, even under very high powers. Lütkemüller* has examined the cell-wall in other species of *Roya* and always found it to be quite structureless; and as a result of his observations he considered that the genus should be removed from the position near *Closterium*, assigned to it by W. & G. S. West (*British Desmidiaceæ*, I. 106, 1904), and placed among the Saccoderm Desmids, in the Tribe Spirotænieæ (near *Mesotænium*): West (*Algæ*, i. 380, 1916) agreed to this change.

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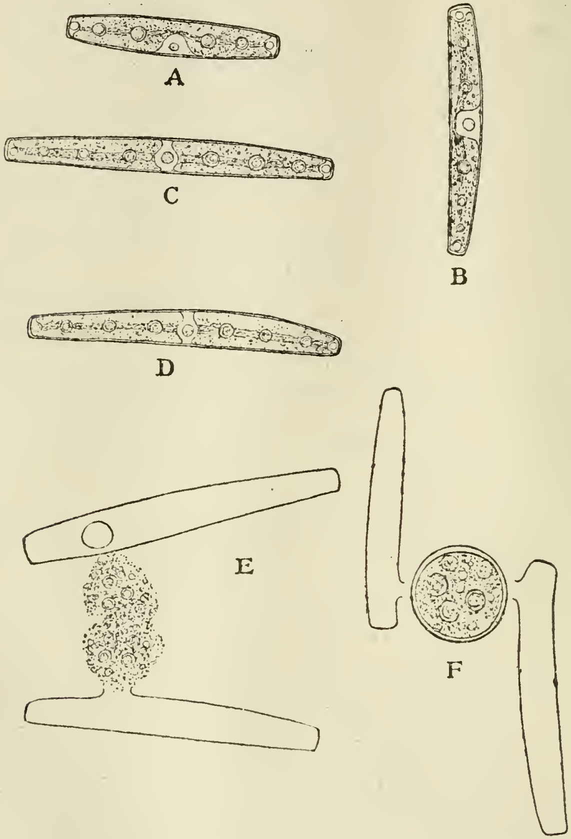
* "Zur Kenntnis der Desmidiaceen Böhmens," Verhandl. der k.-k. zool.-bot. Ges. Wien, lx. 479, 1910.



A. Fairly young vegetative cell, showing single chloroplast, lateral nucleus, and end-vacuoles. **B.** Somewhat older vegetative cell. **C, D.** Fully matured vegetative cells in which the chloroplast has divided in the middle into two parts, and the nucleus taken up a central position. **E.** Two cells in conjugation, showing the extruded gametes uniting. **F.** Mature zygospore. All ×500.

The chloroplast is generally single, axile, with (4?) longitudinal ridges, which, however, were sometimes very indistinct, and a lateral indentation in the middle where the nucleus is lodged (A, B); while there are 4–6 pyrenoids in a central series. The chloroplast was usually observed to be in this condition, but in the case of older cells, and almost always in very long individuals, it was frequently completely divided in the middle, the nucleus then being in a central position between the two half-chloroplasts (C, D). This division of the chloroplast appears to be preliminary to cell-division, but exactly how long the condition persists before the cell actually divides, or whether the divided chloroplast is to be considered a normal feature of the adult cell cannot definitely be stated.

W. & G. S. West (in Journ. R. M. S. 1896, t. iii. fig. 23 *a* ′) have given a figure of *Roya obtusa*, var. *montana* showing the chloroplast completely divided in the middle, but no mention of this is made in the test. Lütkemüller * also figures an example of this condition in *Roya obtusa*, and says: "kommen aber auch oft genug Exemplare des *Cl. obtusum* zur Beobachtung deren Chlorophoren in der Zellmitte nicht einen seitlichen Ausschnitt, sondern eine vollständige Unterbrechung zeigen."

As such individuals might be mistaken by a beginner for a species of *Closterium*, it should be noted that in the latter genus division of the chloroplast into two takes place very early, and is usually completed before the young daughter-cells have separated. The greatly delayed division of the chloroplast is thus very characteristic of the genus *Roya*. In *R. cambrica*—which has been found several times in some marshes at Bearwood, near Birmingham—such cells with two chloroplasts were only rarely seen, in fact the condition was observed only in cells obviously soon going to divide.

Lütkemüller (*l. c.*) states that some species of *Closterium* are known in which "das Chlorophor in der Zellmitte der Regel nach nicht unterbrochen sondern nur seitlich ausgeschnitten ist (*Cl. Linea*, *Cl. acutum*)." But W. & G. S. West's figures (*Desmidiaceæ*, i. t. xxiii.) of *Cl. Linea* Perty [=*Cl. acutum* var. *Linea* (Perty) W. & G. S. West], and *Cl. acutum* (Lyngb.) Bréb. show two distinct chloroplasts, and it may be that Lütkemüller's statement was based upon observation of abnormal specimens. *Cl. acutum* was found by the present writer in a small pond near Birmingham, in 1918, but the cells always showed two chloroplasts.

Very striking in *R. anglica* is the fact that the distal extremities of the chloroplast are always markedly *concave*, and at each end of the cell there is a conspicuous vacuole in which, however, no granules of any sort were ever seen (see A–D). These characters at once distinguish the present species from the three previously described species of *Roya*. W. & G. S. West (*op. cit.* 106) considered that the rounded ends of the chloroplast, and absence of terminal vacuoles, to be amongst the most characteristic features of the genus *Roya*, but such characters cannot now be regarded as of generic importance.

With regard to the presence of apical vacuoles in *R. anglica* it is interesting to note that Lütkemüller (*l. c.*) has described a species of *Closterium* (*Cl. carniolicum*) in which terminal vacuoles are absent, so that just as apical vacuoles are not constantly present in *Closterium*, they are not constantly absent in *Roya*. In *Penium*, likewise, apical vacuoles are present in some but absent in other species. The absence of granules in the terminal vacuoles of *R. anglica* is hardly to be considered of much importance; under somewhat different external conditions it is possible that they would develop. In *Closterium*, in one and the same species, their presence and number is often variable; Lütkemüller, for example, figures (*l. c.* t. i. fig. 11) an individual of *Cl. pusillum* var. *monolithum* with no granule in the end-vacuoles, although normally a single moving granule in each vacuole is present in this Desmid.

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* "Desmidiaceen aus der Umgebung des Millstättersees in Kärnten," *op. cit.* l. 61 (1900).

As already remarked, a very large number of cells were in conjugation. Two cells about to conjugate approximate and become embedded in a mass of mucilage. The mucilaginous masses observed floating in the water consisted mainly of agglomerated conjugating cells and zygospores, while vegetative cells were mostly free in the water, and appeared to develop very little if any mucilage. Each of the two conjugating cells puts out a protuberance, which, by local dissolution of the cell-wall, becomes a pore, through which the cell-contents emerge as a gamete (E). The pore is circular, and the cell-wall round it has a slight outward curl, making the aperture somewhat tubular; this apparently may be produced at any point in the cell-wall, except at the thickened extremities. The zygospore (F) is globose, with a thick, hyaline, smooth wall. This agrees with *R. obtusa* (=*Cl. obtusum* Bréb.), observed in conjugation by Kirchner*, who states that the zygospores of this species are "kugelig, glatt, in eine dicke Schleimhülle eingeschlossen." G. T. Harris, however, who found *R. obtusa* var. *montana* W. & G. S. West in conjugation in bogs on Dartmoor, records the zygospore as ellipsoid and smooth (size $22\,\mu \times 15\,\mu$) †; but the figure given by him (t. xix. fig. 11) does not show the pores in the cell-walls of the empty cells, through which presumably the gametes emerged. As far as I am aware, these are the only records of species of *Roya* having been found in conjugation.

In its mode of conjugation *R. anglica* recalls *Gonatozygon* rather than *Closterium*, but the characters of cell-wall and chloroplast at once distinguish it from the former genus. In the fact that it has apical vacuoles, concave ends to the chloroplast, and the latter, in mature cells, frequently completely divided in the middle, *R. anglica* resembles *Closterium* and *Penium* much more closely than do any of the other species of *Roya*. Indeed, it seems that the chief distinguishing characters on which *Roya* can be retained are (1) the simple structureless nature of the cell-wall, and (2) the fact that division of the chloroplast into halves is delayed until the cell has reached mature age, or even until it is about to divide.

---

* Beitr. Algenflora Würt. in Jahresh. Ver. f. nat. Naturk. Württemberg, 1880, p. 173.

† "The Desmid Flora of Dartmoor," Journ. Quekett Micros. Club, xiii. 254 (1917).

Whether these characters alone are sufficient to base a genus upon, or whether it would be better to consider *Roya* as a subgenus of *Closterium*, or even to drop it altogether and include the four known species in *Closterium*, depends, of course, upon the degree of importance which observation shows can be attached to such characters. For the present, at any rate, it seems desirable to retain the genus on the following modified basis:—

Roya W. & G. S. West in J. R. M. S. 1896, 152, descr. emend. Cellulæ non constrictæ, cylindraceæ vel subcylindraceæ, rectæ vel leviter incurvæ, utrinque levissime attenuatæ, apicibus plus minusve truncatis vel obtuso-rotundatis; membrana cellularum sine poris, levi, achroa; chromatophora singula, vel, cellulis maturis, in medio in duas partes divisa, axili, extremitatibus vel rotundatis et prope apices attingentibus, qui tum nullum locellum apicalem habent, vel extremitatibus concavis, et tum cellulæ locellis apicalibus instructæ; nucleo vel laterali, in mediana incisura chromatophoræ singulæ posito, vel, in cellulis maturis, centrali, inter duas chromatophoras; pyrenoidibus pluribus mediana serie dispositis.

Roya anglica West, sp. nov. R. cellulis parvis, cylindraceis vel subcylindraceis, utrinque levissime attenuatis, rectis vel leviter incurvis, apicibus subtruncatis, diametro 5–15(—20)-plo longioribus; membrana cellularum levis, achroa, ad extremitates leviter incrassata; chromatophora axilis, jugis longitudinalibus (4?) prædita, extremitatibus concavis, primo singula, postea cellulis maturis in medio in duas partes divisa; cellulæ locellis apicalibus instructæ; nucleus vel lateralis in mediana incisura chromatophoræ singulæ positus, vel, in cellulis maturis, centralis inter duas chromatophoras; quæque cellula pyrenoidibus 4–6 medianis instructa. Zygosporæ globosæ leves.

Long. cell. 35–80(–112) μ; lat. max. cell. 7·5–9 μ; lat. apic. 5–7 μ; diam. zygosp. 20–26 μ.

Hab. in aqua minime profunda, Quinton, prope Birmingham (April 1916).

My best thanks are due to Mr. W. B. Grove, M.A., who kindly helped me to look up several obscure references in connection with this paper.

CEPHALANTHERA Richard or EPIPACTIS Crantz?

By Colonel M. J. Godfery, F.L.S.

In Oest. Bot. Zeitschrift (1889, pp. 395–9, 422–430) appeared an extremely able and interesting paper by Dr. R. v. Wettstein, the main object of which was to show that the genus *Cephalanthera* has been wrongly separated from *Epipactis*, and which further suggested that *Cephalanthera*, *Epipactis*, and *Limodorum* should be re-united in one genus—*Epipactis* Crantz.

In 1815 L. Richard (De Orchid. Eur. Adnot. pp. 51–2) first separated *Cephalanthera* from *Epipactis*, characterizing the genera as follows:—

CEPHALANTHERA.

"*Ovar.* sessile; non contortum. *Cal.* erecto connivens. *Lab.* inerme; amplexans interruptum: Hypochilium dorso gibbum; Epichilium apice recurvum. *Gynost.* longum; rectum. *Gyniz.* transverso-oblongus, prominens. *Rost.* nullum. *Anth.* marginalis; elliptico-subrotunda; imâ tantúm parte dorso Gynizi incumbens, cætero apertè eum superans: loculi connectivo ipsis crassiori anticè adnati. *Poll.* massæ lineares; demúm dorso Gynizi per imam partem adhærescentes: granula simplicia."

EPIPACTIS.

"*Ovar.* pedicellatum; non contortum. *Cal.* patens; laciniis subconformibus. *Lab.* inerme; deorsúm patentiusculum nec amplexans; interruptum; Hypochilium concavo-gibbum; Epichilium introrsùm ad basim bigibbum. *Gynost.* brevissimum; ratione ovarii ad posteriora declinans. *Gyniz.* subquadratus, deorsum prominens. *Rost.* apiculare, brevissimum obtusum. *Anth.* marginalis; postica; cordata obtusè acuminata. *Poll.* massæ oblongo-ovatæ; propè apicem adglutinales: granula veluti triquadriglobulata."

H. G. Reichenbach (*Icones*, xiv. 1851) differentiates them as follows:—

"Labelli medio constricti, subarticulati pars inferior cum gynostemio parallela basin versus cum eodem connata. Gynostemium semiteres, gracili, anthera oblonga, glandulæ nullæ" (p. 133).

"Labellum medio constrictum, articulatum, cum gynostemio rectangulum. Gynostemium breve, anthera obtusa triangula erecta, glandula rotunda" (p. 139).

Bentham and Hooker (Gen. Plant. iii. 485, 1883) give the following:—

"Sepala conniventia. Labellum supra basin concavam v. breviter saccato-calcaratam constrictum. Columna longiuscula. Caulis foliatus, floribus capsulisque erectis.'

"Sepala patentia. Labellum supra basin latam concavam constrictum. Caulis foliatus, floribus capsulisque nutantibus v. pendulis."

Wettstein first criticizes Richard's diagnosis, suggesting that any classification of orchids, based on European species only, must be faulty. He asserts that the length of the flower-stalk, and the consequent attitude of the flowers, are not of generic value, and that the characters of the rostellum, stigma, and anther are inconstant, the stigma in *Cephalanthera* being sometimes round (*C. rubra*), sometimes transversely elliptical (*C. grandiflora*), or nearly quadrangular (*C. cucullata*), whilst in *Epipactis* it is quadrangular (*E. latifolia*) or rounded (*E. palustris*). Further, the anther in *Cephalanthera* is round (*C. rubra*) or slightly cordate (*C. cucullata*), in *Epipactis* sometimes the former (*E. palustris*), but as a rule the latter. The difference in the pollen-grains he dismisses as unimportant, for in *Cephalanthera* they are also grouped in tetrads, and merely become free somewhat earlier than in *Epipactis*. He therefore claims that the only remaining difference is that the petals and sepals are connivent in *Cephalanthera* and spreading in *Epipactis*—a character manifestly not of generic value.

We may at once admit that the presence or absence of a flower-stalk, and the slight differences in the shape of the anther, and even of the stigma, are characters of relatively small value. The criticism of the stigma-characters is chiefly founded on the "nearly quadrangular" stigma of *C. cucullata.* We shall see later that that species is untrustworthy as evidence of the existence of a quadrangular stigma in the genus *Cephalanthera*, so that Richard's diagnosis in this respect still holds good. The explanation as to the pollen-grains appears to be somewhat disingenuous. The tetrads of pollen in *Cephalanthera* resolve into separate grains *in situ*, in *Epipactis* they do not then separate at all. Only when they come into contact with the viscid secretion of the stigma do they swell and disintegrate, as is usually the case in the Orchidaceæ. Disintegration *before* pollination is a very different thing from disintegration brought about by the action of the stigmatic fluid. Even assuming that the author is correct in his statement that in *Cephalanthera* the pollen-grains are originally bound together in tetrads, the difference in the pollen-grains pointed out by Richard is undiminished in importance.

He next deals with the new character adduced by Reichenbach fil.—the absence of a viscid gland in the case of *Cephalanthera*, its presence in *Epipactis*. He says, in effect—I could reasonably pass over this character as of very little value, if indeed the very mention of it does not prove the difficulty of fixing a boundary between the two genera. Real viscid glands, *i. e.* a thorough transformation of the tissue of the rostellum contiguous with the anther into a viscid gland, certainly occur in some species of *Epipactis*, yet it generally decreases with the reduction of the rostellum, the species with a short rostellum (e. g. *E. palustris*) show only small viscid glands, whilst the development of the latter in species of *Cephalanthera* with a scarcely discernible rostellum entirely fails to take place.

In this the learned author shows an absolute failure to understand or appreciate the capital importance of the viscid gland, which is the most outstanding and weighty character in Orchidaceæ, is peculiar to that order, and is the root-idea of its floral construction. The one unique character of the Orchidaceæ, which puts them on a different plane from all other natural orders (except perhaps the Asclepiadaceæ), is the extremely ingenious mechanical device by means of which insects are unconsciously induced to convey the pollinia from one flower to the stigma of another, usually that of a separate plant.

One of the most remarkable things in the morphology of the order is the absence of a rostellum in *Cephalanthera*, an absence which reduces that genus from the exalted position of possessing one of the most ingenious contrivances for the transport of pollen in the vegetable kingdom, to the status of ordinary self-fertilized plants. Self-fertilization is the simplest of all conceptions—it needs no honey, no scent, no colour, no co-operation of insects, or even of wind or water. *Cephalanthera* is a decadent genus, which has fallen from its high estate, assuming that it is really the case that it is entirely self-fertilized, and that we have not simply so far failed to understand the mechanism of the flower. It was evidently originally designed for insect-fertilization. From a *biological* point of view it is now more widely separated from *Epipactis* than is the latter from genera possessing a rostellum. The presence or absence of a rostellum is of much greater importance than the presence or absence of caudicles,—though these latter characters are used to differentiate the two great divisions of the subfamily *Monandræ—Basitonæ* and *Acrotonæ*—for cross-fertilization can and does take place without caudicles, but not without viscid glands. All the other differences between *Cephalanthera* and *Epipactis*, such as the presence or absence of a peduncle, the position of the flower, the extent to which it opens, the shape of the lip, &c. are of but secondary importance, and not differences of the first rank, like the absence of a rostellum.

The author's argument that the rostellum is smaller in *E. palustris*, and therefore on the way to disappearance, seems to be mere special pleading—so long as a rostellum is effective, its size is of no importance. It will be noticed that the author does not refer to Reichenbach's characters—"gymnostemium semi-teres, gracile" for *Cephalanthera*, and "gymn. breve" for *Epipactis*. Yet this is a distinction of considerable importance, the relatively long cylindrical column of the former being in sharp contrast to the short squat column of the latter.

The author having thus minimized or explained away the differentiating characters of previous writers, not unnaturally considers that the time has come to re-unite the two genera. He gives a beautifully drawn series of lips to show how they gradually merge into each other, and form a homogeneous whole.

He further points out that the epichile in *Ceph. cucullata* has a distinct though short spur, and that in the very similar lip of *Limodorum abortivum* the spur is merely more developed. He therefore considers that the genus *Limodorum* does not essentially differ from *Epipactis*, and proposes that it should be included in the latter.

Having never seen *Ceph. cucullata*, I was anxious to learn what I could about a plant which bulked so largely in the author's argument. Turning to the figure of it in Reichenbach's *Icones* (Tab. 120) I was much struck by its remarkable aspect. It suggests abnormality. The three lower leaves are represented by loose funnel-shaped sheaths enclosing the stem, the 3 or 4 upper are bract-like, erect, embracing the stem. The flowers resemble those of *Ceph. grandiflora*, but have a very short spur. Altogether it is a most remarkable plant. Turning next to the figure of *Limodorum abortivum* in Tab. 129, I was astonished to find how extraordinarily similar its leaves are to those of *C. cucullata*—the same three lower perfoliate funnel-shaped sheaths, the same upper bract-like amplexicaul leaves. In view of the unique character of the leaves of *Limodorum* this resemblance can hardly be accidental. I think that anyone expert in recognizing the characters of the parents in orchid-hybrids, on comparing these figures, will admit that there is a strong presumption that *C. cucullata* is a hybrid between *Limodorum* and some species of *Cephalanthera*. The leaves are essentially those of the former, just so much modified as might be expected from the influence of *Cephalanthera*, the column is that of the latter; whilst the short spur (unknown in any other species of *Cephalanthera*) is just what might occur in a cross between a moderately long-spurred and a non-spurred flower. Reichenbach states (*l. c.* 133) that he had very recently been informed that a specimen had been found with a *long* spur, *i. e.* nearer to *Limodorum* than the one figured. As is well known, individual hybrids incline sometimes to one parent, sometimes to the other.

His statement (*l. c.* 137) that *C. cucullata* had only once been found confirms the supposition that it is a hybrid—had it been an indigenous species it would hardly have been so excessively rare, unless on the verge of extinction. The following points in his description appear to indicate the influence of *Limodorum*—Caulis validus, vaginæ tres . . . . . membranaceæ, amplissimæ, ore obliquo acutiusculæ, rostellum obtuse 4–5 dentatum (apparently the upper edge of the stigma is referred to). It may be added that Dr. Wettstein's figures show considerable similarity between the lips of *C. cucullata* and *Limodorum.*

If this supposition is correct, the author's arguments based on *C. cucullata* are put out of court, and his plea for the inclusion of *Limodorum* in the genus *Epipactis* falls to the ground.

It is interesting to note the circumstance under which Dr. Wettstein's paper was written. He had just been studying a hybrid between *C. grandiflora* and *E. rubiginosa*, and the need of choice of a generic name for it led him to make an exhaustive study of the two genera. He had evidently a strong bias against the probability of the occurrence of bi-generic hybrids, for he argues that the very existence of this hybrid pleaded for the union of the two genera in one. I might adduce, he says, as a new proof of the correctness of my view, that in most cases the occurrence of bi-generic hybrids ought to suggest the homogeneity of the genera concerned. He was thus handicapped by a preconceived idea. In botanical investigations an open mind is essential. A biassed mind cannot exercise unbiassed judicial functions—the judge is at heart an advocate. The link which in Dr. Wettstein's opinion joined, in the one case *Cephalanthera* and *Epipactis*, in the other *Epipactis* and *Limodorum*, was in each case a hybrid. His prejudice against bi-generic hybrids prevented him from giving due weight to the unanswerable evidence of former writers as to the differences between the genera in question, and to lay undue stress on the occurrence of a spur in *C. cucullata*, which might have been, and in all probability actually was, due to hybridity.

A careful study of Dr. Wettstein's otherwise very able paper leads to the conclusion that *Cephalanthera*, *Epipactis*, and *Limodorum* are generically distinct, for his arguments entirely fail to shake the position taken up by earlier writers.

Cephalanthera cucullata is, in all probability, a hybrid between *C. grandiflora* and *Limodorum abortivum.* When Reichenbach wrote his description he was not sure whether the flowers were white or rosy, and naïvely states that in his figure he has shown them as white, but that this can easily be altered should they eventually prove to be rose. In his second supplement, however (*l. c.* 181), he announces that they are 'luride alba,' as in *C. grandiflora.*

P.S.—Since writing the above I have come across a footnote by Dr. G. R. v. Beck to his paper Erwiderung auf Dr. Wettstein's

Besprechung meiner Flora von Niederösterreich (Oesterr. Bot. Zeitschr. 1891, p. 99) in which he quotes Wettstein as saying that no one who saw *Epipactis cucullata* could doubt that it and *Limodorum* unmistakably belong to the same genus.

This is interesting as showing that Wettstein clearly recognized the close affinity of *E. cucullata* to *Limodorum*, and strongly confirms the supposition that it is a hybrid of which the latter is one of the parents.

ALABASTRA DIVERSA.—PART XXXII.

By Spencer Le M. Moore, B.Sc., F.L.S.

3. PLANTÆ ROGERSIANÆ.—V.

(Continued from Journ. Bot. 1919, 91.)

For most of the descriptions in this section I am indebted to Mr. Edmund Baker, who kindly consented to examine and report upon the *Leguminosæ*. For the remaining descriptions I am myself responsible.

LEGUMINOSÆ.

CROTALARIA SPARTEA Planch.

Belgian Congo: Elisabethville, 10939.

CROTALARIA DESCAMPSII Micheli, forma foliolis majoribus 15–30 × 5–10 mm.

Belgian Congo: Nieuwdorp, 10404.

CROTALARIA SPINOSA Hochst. subsp. ACULEATA Bak. fil.

N.W. Rhodesia: Kafue station, 8719.

Crotalaria (*Eucrotalaria*) **cataractarum** Bak. fil., sp. nov.

Caulis erectus, copiose ramosus. *Stipulæ* parvæ. *Folia* trifoliolata, foliolis oblongis vel elliptico-oblongis, apice rotundatis 12–18 mm. longis, 10–12 mm. latis, petiolo communi 12–15 mm. longo suffulta. *Inflorescentia* pauciflora. *Calyx* extus pubescens in toto 7–8 mm. longus, dentibus subacuminatis. *Vexillum* in sicco flavum, cum ungue ±2 cm. longum. *Carina* dorso angulo recto curvata, hinc in rostrum longum attenuata, in toto 17–19 mm. longo. *Alæ* basi longe unguiculatæ. *Legumen* rectum, oblongum, basi stipitatum cum stipite 20–23 mm. longum.

S. Rhodesia: Victoria Falls, Alt. 3000 ft., 13290.

Belongs to *Eucrotalaria* § *Mediocrifloræ*, and is allied in some respects to *C. maxillaris* Klotzsch.

A copiously-branched shrub with yellow flowers about 2 cm. long, and an oblong shortly stipitate pod, not oviform as in *C. maxillaris*.

Crotalaria (*Eucrotalaria*) **acervata** Bak. fil., sp. nov.

Caulis erectus, longitudinaliter striatus. *Folia* trifoliolata, foliolis anguste lineari-oblongis utrinque attenuatis, 2·5–4·0 cm. longis, 5–13 mm. latis, petiolo communi 1–2·5 cm. longo prædita. *Racemi* terminales pluri-vel multiflori. *Bracteæ* lineari-lanceolatæ persistentes. *Calyx* in toto 5–5·5 mm. longus, dentibus subacumi-

natis. *Vexillum* cum ungue 10–11 mm. longum. *Carina* dorso rotundata, lineis violaceis notata, ±11 mm. longa. *Ovarium* lineari-oblongum, stipitatum, multiovulatum. *Legumen* ignotum.

Belgian Congo: Elisabethville, 10978.

Allied to *C. Nicholsoni* Bak. fil., from Nyasaland and Rhodesia, but the leaflets much narrower.

Crotalaria (*Eucrotalaria*) **macrotropis** Bak. fil., sp. nov.

Caulis erectus, ramosus, longitudinaliter striatus. *Stipulæ* parvæ 2–2·5 mm. longæ. *Folia* trifoliolata, foliolis angustis linearibus vel lineari-oblongis glauco-viridibus pubescentibus, 12–25 mm. longis, petiolo communi 8–10 mm. longo prædita. *Racemi* pluriflori, laxi, terminales. *Flores* pedicellati. *Bracteæ* parvæ. *Calyx* in toto 6–7 mm. longus, dentibus subacuminatis. *Vexillum* in sicco violaceum. *Carina* dorso angulo recto curvata hinc in rostrum longum et rectum attenuata, in toto 15–17 mm. longa. *Legumen* oblongum, ±25 mm. longum, polyspermum, breviter stipitatum.

Belgian Congo: Elisabethville, 10941.

Crotalaria (*Eucrotalaria*) **rigidula** Bak. fil., sp. nov.

Caulis erectus lignosus. *Folia* parviuscula mediocriter petiolata, foliolis oblongo-obovatis glaucis glabris 6–10 mm. longis, 3–5 mm. latis, petiolo communi stricto 10–15 mm. longo suffulta. *Inflorescentia* laxe pauciflora. *Calyx* in toto 8–9 mm. longus, lobis triangularibus 5 mm. longis quam tubo paullo longioribus. *Vexillum* 12–14 mm. longum. *Alæ* in toto 12–13 mm. longæ, 4–5 mm. latæ, basi unguiculatæ. *Carina* dorso rotundata apice sursum curvata, in toto 13–15 mm. longa. *Legumen* oblongum, basi stipitatum, cum stipite 18–20 mm. longum.

North Transvaal: Tzaneen, 12531.

Allied to *C. Monteiroi* Taubert, but petioles longer, leaflets narrower, calyx glabrous.

Crotalaria (*Eucrotalaria*) **homalocarpa** Bak. fil., sp. nov.

Caulis ramosus, ramis junioribus pilosis. *Stipulæ* lineares. *Folia* trifoliolata, foliolis oblongis vel oblongo-lanceolatis, 15–20 mm. longis, 3–7 mm. latis, petiolo communi 8–12 mm. longo suffulta. *Flores* solitarii vel subsolitarii, pedunculati, pedunculis strictis pilosis ±20 mm. longis. *Bracteæ* 2 conspicuæ, infra calycem positæ, lanceolatæ, 6–7 longæ. *Calyx* in toto ±9 mm. longa, lobis lanceolatis quam tubo longioribus. *Vexillum* in sicco luteum. *Carina* basi unguiculata, marginibus interioribus barbata, in rostrum acuminatum sensim attenuata, in toto ±12 mm. longa. *Legumen* ±2 cm. longum et 1 cm. latum, glabrum, suboviforme, seminibus numerosis.

S. Rhodesia: alt. 2400 ft., 13302.

Allied to *C. geminiflora* Dinter, but leaflets narrower and pod glabrous. A pilose plant with solitary or subsolitary flowers. The two bracts below the flowers are conspicuous, as in *C. geminiflora*.

Crotalaria (*Eucrotalaria*) **longistyla** Bak. fil., sp. nov.

Suffrutex erectus ad *C. lukwangulensem* Harms. accedens, ramis junioribus strictis cano-tomentosis. *Folia* parviuscula, trifoliolata, foliolis oblongo-oblanceolatis vel elliptico-oblanceolatis lateralibus 6–10 mm. longis, 4–5 mm. latis, terminalibus majoribus 15–18 mm.

longis, petiolo communi 6–8 mm. longo prædita. *Flores* majusculi, pauci, axillares, pedunculati. *Calyx* in toto 9–10 mm. longus, tubus ±3 mm. longus, dentibus 6–7 mm. longis. *Vexillum* externe pubescens, 17–18 mm. longum. *Carina* dorso angulo recto curvata inde in rostrum longum gradatim attenuata. *Ovarium* marginibus hirtis, stipitatum. *Legumen* deest.

South Rhodesia: between Salisbury and Umtali, 4064.

Noticeable on account of the rather large solitary or subsolitary flowers, the carina being sharply bent and the rostrum 12–15 mm long. The style is also long. Belongs to the subsection *Oliganthæ.*

CROTALARIA HARMSIANA Taub. var. CONGOENSIS Bak. fil.

Suffrutex ramosissimus. *Folia* subsessilia, foliolis oblongis vel oblongo-oblanceolatis 10–13 mm. longis, 3–5 mm. latis. *Calyx* quam in typo paullo major, in toto 7–8 mm. longus. *Carina* dorso genuflexa ±1 cm. longa. *Legumen* oblongum, pilis vestitum 17–20 cm. longum.

Belgian Congo: Elisabethville, 10961.

Differs from type in the longer calyx and pod, &c. The typical form occurs at Bukoba and Buddu.

INDIGOFERA GONIOIDES Hochst. var. nov. RHODESICA Bak. fil.

Perennis? Folia 3–4 juga cum impari, foliolis quam iis typi brevioribus ellipticis vel oblongo-ellipticis vel oblanceolatis 10–15 mm. longis, 3–6 mm. latis. *Flores* racemosi, racemis pedunculatis. *Calyx* in toto 3 mm. longus. *Vexillum* 7–8 mm. longum. *Alæ* 7–8 mm. longæ. Carina 6 mm. longa, longe unguiculata. *Legumen* angustum, 16–24 mm. longum, 1·5–2·0 mm. latum.

South Rhodesia: Buluwayo, 13666; also at Kew from the same locality, *Gardner*, 62.

The type from Abyssinia has longer leaflets and more hairy pods, and is an annual.

INDIGOFERA DIMIDIATA Vog. var. nov. LAXIOR Bak. fil.

Caules elongati, herbacei. *Stipulæ* magnæ. *Folia* trifoliolata, foliolis ellipticis vel oblongo-ellipticis. *Flores* in racemos pedunculatos dispositi, racemis quam in typo laxioribus. *Vexillum* quam carina paullo brevius 5–6 mm. longum et latum. *Carina* naviculariformis, 6 mm. longa. *Legumen* rectum, glabrum, angustum polyspermum.

Transvaal: Barberton, Koopsche Hoop, 21706.

Racemes more lax and flowers longer than in type.

INDIGOFERA BURKEANA Benth. forma.

Calyx in toto ±6 mm. longus, dentibus acuminatis. *Vexillum* 9–10 mm. longum, carinæ æquilongum. *Legumen* teres.

Transvaal: Ragton, Pretoria Div., 20437.

COMPOSITÆ.

HELICHRYSUM LEPTOLEPIS DC.

Northern Transvaal, Zoutpansberg Division, 20003.

Stœbe Mossii, sp. nov. *Fruticulus* crebro ramosus; *ramis* sat gracilibus omnimodo bene foliosis minute albo-tomentosis dein glabris; *foliis* parvulis anguste linearibus acutis basi breviter decur rentibus tortis margine revolutis supra glabris necnon nitidis subtus albo-tomentosis; *capitulis* pluribus in glomerulum globosum congestis; *involucri* oblongo-obovoidei phyllis oblongo-lanceolatis acutis (extimis paullo brevioribus) scariosis exterioribus pilosis interioribus glabris in sicco dilute brunneis; *corolla* subinclusa; *antherarum* caudis brevibus; *styli* ramis truncatis brevissime penicillatis; *achænio* adhuc crudo oblongo apice ipso leviter contracto; *pappi* setis circa 10 ima basi connatis corolla plane brevioribus sparsim plumosis albis.

Cape, Caledon division, Steenbras; *Moss & Rogers*, 1583.

Planta alta spithamea vel semispithamea. Folia 2–3 mm. long. vel paullulum ultra; ·3 mm. lat. Capitulorum glomerulus 6–9 mm. diam. Involucrum 3·2 mm. long.; phylla ext. 2 mm., int. 3 mm. long. Corollæ verisimiliter albæ tubus 2·2 mm. long.; hujus lobi ·5 mm. long. Styli rami ægre 1 mm. long. Achænia 1 mm., pappus 1·5 mm. long.

Near *S. æthiopica* Linn., but entirely different in foliage and with much smaller heads.

Stœbe affinis, sp. nov. *Fruticulus* ramosus, bispithameus; *ramis* omnimodo foliosis cito glabris; *foliis* (ramulorum juniorum imbricatis) lineari-subulatis acutis spiraliter tortis supra glabris subtus albo-tomentosis; *capitulorum* glomerulis globosis; *involucri* phyllis oblongis apice truncatis ipso mucronulatis ext. dorso pilosis scariosis in sicco dilute brunneis; *corolla* inclusa; *antherarum* caudis brevibus; *styli* ramis truncatis penicillatis; *achænio* oblongo compresso glabro; *pappi* setis circa 12 corollæ tubo æquilongis ima basi connatis sparsim plumosis albis.

Cape, Ceres, 1500 ft.; 17605.

Folia 5 mm. long., ·3 mm. lat. Capitulorum glomeruli usque 10 mm. diam., sæpius vero 7–9 mm. Involucrum 3·5 mm. long.; phylla ext. 2 mm., int. 3·25 mm. long. Corollæ roseæ tubus 2·25 mm. long. Styli rami ·75 mm. long. Achænia 1 mm., pappus 2 mm. long.

This also is near *S. æthiopica* Linn., and can be told from it on sight by the leaves and small heads. Heads, except for some minor points, like those of *S. Mossii*, except that the corollas are rose-coloured, but foliage dissimilar.

Metalasia (§ *Glomeratæ*) **Rogersii**, sp. nov. *Fruticulus* prolixus diffuse pauciramosus; *ramis* gracilibus ascendentibus bene foliosis minute albo-tomentosis tandem glabrescentibus; *foliis* parvulis lineari-subulatis mucronulatis parum spiraliter tortis coriaceis supra glabris nitidisque subtus albo-tomentosis maxima pro parte ex ramulis subevanidis oriundis hinc pseudoverticillatis; *capitulis* subsessilibus 3-flosculosis in glomerulos mediocres lana alba dense conjunctos aggregatis; *involucri* cylindrico-turbinati 4–5-serialis phyllis oblongis vel anguste oblongo-obovatis obtusis glabris scariosis roseis; *flosculis* inclusis; *antherarum* caudis abbreviatis apice microscopice ramosis; *styli* ramis truncatis; *achæniis* (crudis) oblongis compressis glabris; *pappi* setis paucis superne leviter incrassatis scabriusculis albis.

South Africa, 17620.

Rami teretes, circa 1 mm. crass. Folia pleraque 1–2 mm. long. Capitulorum glomeruli usque 1 cm. diam. Involucra circa 6 × 2 mm.; phylla ext. 3–3·5 mm., int. 4–5 mm. long. Corollæ 3 mm., styli rami 1 mm., achænia 1 mm., pappi setæ 3 mm. long.

Affinity with *M. Cephalotes* Less. but *inter alia* with entirely different foliage.

CONVOLVULACEÆ.

Merremia kentrocaulos Rendle var. *pinnatifida* N. E. Br.

Transvaal, Zoutpansberg Div., Messina, 20846.

This is an addition to the Transvaal flora.

SOLANACEÆ.

Solanum (§ *Leptostemonum*) **Rogersii**, sp. nov. Verisimiliter suffrutex, spinosus; *ramis* teretibus crebro foliosis pilis glandulosis dense pubescentibus spinis rectis sat longis a basi gradatim attenuatis rubescentibus sat copiose indutis; *foliis* solitariis petiolatis ambitu ovatis alte pinnatifidis segmentis lanceolatis acutis acute dentato-lobatis pag. utravis pilis glandulosis stellatis intermixtis pubescentibus costa media utrobique subsparsim longiuscule spinosa costis lateralibus spinas paucas debiliores ostendentibus; *cymis* ex axillaribus pedunculatis sublaxe plurifloris foliis circiter æquilongis vel subæquilongis dense glanduloso-pubescentibus pedunculo satis valido spinoso; *pedicellis* calyce sæpius longioribus uti calyx spinis parvis onustis; *calycis* campanulati pubescentis segmentis triangulari-lanceolatis acutis tubum facile excedentibus; *corollæ* lobis tubo multo longioribus ovatis obtusis mox reflexis extus pilosis verisimiliter dilutissime cæruleis; *filamentis* inter se liberis quam antheræ liberæ superne leviter angustatæ poris parvis solummodo dehiscentes plane brevioribus; *stylo* ex antheris eminente glaber.

Transvaal, Barberton, 20291.

Ramorum spinæ maxima pro parte 3–5 mm. long. Folia (petiolo 3 cm. long incluso) usque 12 cm. long., sed sæpius 6–10 cm. (petiolo 1–2 cm.); rhachis inferne 1–2 mm. lat., superne 5 mm. vel etiam magis (folia prope apicem lobata); segmenta pleraque 1·5–3 cm. long., ±1 cm. lat.; spinæ costæ centralis pleræque 7–10 mm. long., basi 1–1·5 mm. lat. Cymæ 8–9 cm. long., circa 4 cm. diam.; pedunculus 2–3 cm. long. Pedicelli floritione peracta recurvi, 1–1·5 cm. long. Calycis segmenta 7 mm. long. Corolla diam. circa 2·5 cm.; lobi 14 mm. long. Filamenta vix 2 mm. long.; antheræ 8 mm. long, basi 2 mm., apice fere 1 mm. lat. Stylus 1 cm. long.

The species can be distinguished on sight from *S. supinum* Dun. and its allies by the acute points of the leaf-segments.

Conspecific with this but with somewhat smaller and apparently more deeply coloured flowers is a specimen (*Moss & Rogers*, 2062) from Canada, Witwatersrand Div. This is a larger specimen and shows more of the plant including the lower part of the stem, which is fistular and nearly 5 mm. thick. Besides flowers, this specimen has spheroidal, reddish berries measuring 10 mm. in diameter. The leaves, although similar to those of the type, generally run smaller, the upper ones being only 4 cm. in length or even less.

4. PHYLLANTHI EX RHODESIA SPECIES NOVA.

Phyllanthus Eylesii, sp. nov. *Herba* monoica, pro rata elata, glabra; *ramis ramulis* que aliquanto angularibus his bene foliosis; *foliis* brevipetiolatis late oblongis vel anguste oblongo-obovatis obtusissimis apice ipso brevissime apiculatis membranaceis opacis; *stipulis* petiolos excedentibus setaceis decoloribus; *floribus* ♂ subsessilibus sepalis 6 ovato-oblongis obtusissimis glandulis minutissimis inter se liberis antheris 3 filamentis perbrevibus connatis insidentibus; *floribus* ♀ quam ♂ majoribus necnon longius pedicellatis sepalis ovato-oblongis obtusis costa prominente percursis glandulis 6 in cupulam lobatam brevem plus minus connatis ovario globoso glabro stylis 3 superne divergentibus bicruris.

Rhodesia, Victoria Falls, rain forest; *Eyles*, 1296.

Folia usque 20×8 mm., pleraque ±15×7 mm., supra in sicco viridia, subtus glaucescentia; petioli modo 1 mm. long. Stipulæ pleræque circa 2 mm. long. Fll. masc. pedicelli ·3 mm., sepala ·6 mm., antheræ ·5 mm. long. Fll. fem. pedicelli 1–1·15 mm. long.; sepala cito 1·5 mm. long.; ovarium ·5 mm. diam. Capsula fere 3 mm. diam. Semina 1·2 mm. long., brunnea, dorso eleganter striatula.

Near *P. leucanthus* Pax, which, besides lanceolate stipules, has larger flowers, the males with anthers on a distinct column among other features.

5. ACANTHACEÆ PAPUANÆ A CL H. O. FORBES LECTÆ.

In the course of some work upon the *Acanthaceæ* of New Guinea advantage was taken of the opportunity to name the undetermined specimens belonging to that group forming part of Mr. H. O. Forbes's collection from that island. The full list of species here given contains none new to science, but two (*Ruellia Forbesii* and *Aporuellia versicolor*) were described in this Journal for 1914, 294–5.

RUELLIA FORBESII S. Moore. Mt. Sogere at 2000 ft. No. 839*a*.

RUELLIA BRACTEATA R. Br. Fort of Astrolable Range, 1200 ft. *Sine no.*

The leaves of the specimens are somewhat smaller than those of tropical Australian ones, and the plant is more hairy with rather coarse hispidulous hairs: also the flowers are white, not blue as Bentham says of the Australian. But with the rather unsatisfactory material before one, it is difficult to find any points to justify the suspicion of a new, and in any event certainly very closely allied species. This has not hitherto been reported from New Guinea.

APORUELLIA VERSICOLOR S. Moore. Mt. Sogere 1750–2500 ft. Nos. 73, 781.

Flowers cream-coloured or bright orange.

HEMIGRAPHIS REPTANS T. And. Mt. Sogere, 2000 ft. No. 841.

German writers give Engler in Bot. Jahrb. vii. 474 (1886) as the authority for this name, but it should be assigned to T. Anderson ex Hemsley in *Bot. Voy. Challenger*, i. iii. 173 (1885). It is the *Ruellia reptans* of Forster.

Acanthus ilicifolius L. Sogere region. No. 927.

All the leaves are quite entire.

Justicia Chalmersii Lindau, ex descript. Bosi-bosi, *sine no.*

This is referred to § *Adhatoda* by Lindau; according to Clarke's views, which seem better founded, it belongs to § *Calophanoides*.

Justicia cardiochlamys Lindau, ex descript. Mt. Sogere, 1750–1800 ft. Nos. 629, 782.

A straggling and trailing shrub: flowers white or cream-coloured. This Clarke would also have regarded as a member of § *Calophanoides*. Lindau places it in § *Monechma*, but as it has a relatively long ovary with two ovules, both evidently developing into seeds, in each cell, while Nees's main character for *Monechma* depends upon the short 2-seeded capsules, each cell with only a single ἔχμα or retinaculum, it is clear that the plant has nothing to do with *Monechma*.

Graptophyllum Gilligani comb. nov. *Justicia Gilligani* Bail. Sogere, 2500 ft. No. 51.

Clarke (MS. in herb. Kew.) was the first to refer this plant to its proper genus though, for what reason is not apparent, he gave it a manuscript name of his own which, of course, is not published here. From *G. pictum* Griff. it can be told on sight by the narrow lobes of the corolla-lips.

Calycacanthus Magnusianus K. Schum. Gawada, 3000 ft.

An excellent specimen of this fine plant. Clarke has recorded (MS. in herb. Kew.) his doubt whether the genus should not be merged in *Graptophyllum* relying, as would appear, upon the absence of staminodes, but overlooking the corolla with its very long lips and their short lobes.

DEWEVRELLA CONGENSIS, sp. nov.

By H. F. Wernham.

This genus of *Apocynaceæ* (§ *Echitideæ*) was founded so recently as 1907 by De Wildeman, upon several specimens collected in the equatorial region of the Congo-basin by members of the Laurent Mission (De Wild., Miss. E. Laurent, i. 548, tt. clxiv, clxv); it is dedicated to one of them, M. Alfred Dewèvre.

The single species described, *D. cochliostema*, was found in the environs of Eala, which lies close to the point where the tributary river Ikelemba empties itself into the Congo—that is at the Equator. Collections were made in the same district in 1914 by M. A. Nannan, of the Belgian Agricultural Department. I have described already some Rubiaceous novelties of this latter collection in this Journal for 1918 (vol. lvi. pp. 308–313). I now describe a second species of *Dewevrella*, readily distinguished from *D. cochliostema* by the size and shape of the leaves and the calyx-segments, and gathered by Nannan in the same district.

Dewevrella congensis, sp. nov.

Frutex altiuscule scandens cirrhosus, ramulis gracillimis junioribus tenuissimis, minute rufo-puberulis demum necnon tardiuscule glabratis.

Folia inter minora (pro familia inter minima) papyracea, opposita, plerumque ovato-lanceolata, leniter acuminata apice acuta, basi truncato-obtusissima, *petiolo* notabili nisi breviusculo, utrinque nisi medianâ in venâ subtus prominula supra impressa rufo-puberula glabra, in siccitate discoloria supra fusco-olivacea subtus læve brunnea venis lateralibus obscuris raro manifestis. *Flores* parvi cymosis in inflorescentiis corymbosis ebracteolatis laxe dispositi alaribus paucifloris foliis manifeste brevioribus; *pedunculis* brevibus nonnunquam obsoletis, qua *pedicelli* elongati minute ferrugineo-puberulis tenues, *bracteis* exiguis. *Calycis* lobi angusti lineari-lanceolati acuminati acuti; *corollæ* tubus brevissimus infundibularis lobis lineari-oblongis obtusissimis.

Nannan 104! Boyeka (Equator), 28 August, 1914. *Herb. Mus. Brit.*!

This is described as a " . . . . grande liane, latex blanc; petite fleur jaune. Peu repandue." The native name is given as *Teili*.

The specimen taken as type consists of a few twigs, with very slender stems, obviously twining. The *leaves* are approximately 3·5 cm. long at most, and 1·5 cm. broad, with *petiole* about 3 mm. in length, rarely longer. A typical *inflorescence* consists of six to ten flowers arranged sub-corymbosely, with very slender *pedicels* a centimetre or more in length, set upon *peduncles* barely one-third as long. The *calyx* barely exceeds a millimetre in length, its lobes narrow and pointed. *Corolla* 5 mm. long, over four-fifths of this length attributable to the lobes.

RHAPHIDOSTEGIUM CŒSPITOSUM (Sw.) AND ITS AFFINITIES.

By H. N. Dixon, M.A., F.L.S.

My first introduction to *Rhaphidostegium sphærotheca* (C. M.) Jaeg. was a very pleasant one. It came in a box from Table Mt. with a magnificent bouquet of white "Cape Lilies"; it was a large and well grown form, and it gave the impression of being, among Rhaphidostegia, a distinct and well-marked species. That was when my acquaintances among South African mosses were very few.

I cannot say that closer familiarity has ripened the friendship. As more specimens accrued, it became evident that the original plant was by no means the only form, nor indeed the most frequent—rather, indeed, an extreme and unusually fine form, under the glamour of which the species had acquired in my eyes an undeservedly high reputation, which the subsequent forms did little or nothing to support. Not only were these, while structurally identical, much smaller and more commonplace, as a rule, but they began to evince an inclination to vary, and to diverge from what I had fondly considered a well-marked type, and to approach other *Rhaphidostegia* of a much more ordinary character, until it became evident that one had to do, not with a single, well-defined type, but with a "Formenkreis" of considerable radius and an uncomfortably indefinite circumference; so that in course of time it happened with *R. sphærotheca* as with certain other nationals of late, that what to me had once been a welcome guest began to take on the appearance of an undesirable alien.

Not only did *R. sphærotheca* appear in some of its forms to come uncomfortably near to other South and Central African species of the genus, but it even invaded the ranks of other genera, for having occasion to examine *Pterogoniella Stuhlmanni* Broth. from Usambara, I recognized not only (as Brotherus himself had already done) that it belonged to *Rhaphidostegium*, but also that it was a large, scorpioid-branching form of *R. sphærotheca*, almost identical, in fact, with my original Table Mt. acquaintance.

Having subsequently to examine *R. Duisaboanum* (Mont.) Jaeg., from the Mascarene Is., I became at once aware that I had to do with the same species, and it was therefore interesting to find that Bescherelle, with his wide knowledge of continental and insular forms, had recognized it as a highly variable species, and had brought into its synonymy, among other things, *Hypnum Robillardii* Duby, which had got into so far removed a genus as *Leucomium*. He describes several forms and varieties of the species.

Now I have learned that in the somewhat rare cases when a species of moss has a fairly wide distribution in Southern and Central Africa, and in Madagascar and the East African Islands, and more especially when it is a plastic species, it is desirable to look further afield, and see if it be not identical with some well-known species of South America, or of Australasia, or both—*Dicranoloma Billardieri*, *Ditrichum flexifolium*, and *Campylopus introflexus* are cases in point. Bescherelle (Fl. Bryol. Réunion, 160) indicates the clue when he writes of *R. Duisaboanum* :—" Le *Rh. Duisaboanum*, de même que le *Rh. cespitosum* des Antilles, varie beaucoup comme port, comme couleur et comme disposition des feuilles ; cette différence tient sans doute a l'influence des localités où il a été recueilli, car on ne rencontre dans les diverses variétés enumerées ci-après aucun caractère assez saillant pour constituer une éspèce speciale."

The possibility of the identity of the two, however, had not, it appears, occurred to him. My object in this paper is to establish the identity, not only of these two, but of several other described species from various parts of the world.

The South American and West Indian plants of this group have been described under the principal headings of *Hypnum cæspitosum* Sw., from the West Indies ; *Hypnum loxense* Hook. from Peru ; *H. lithophilum* Hornsch. and *H. galipense* C. M. from tropical South America. C. Mueller by the time of the publication of the *Synopsis* had recognized that of these *H. galipense* was identical with *H. cæspitosum*, and *H. lithophilum* not more than a variety of *H. loxense*, so that the geographical areas of the two already considerably overlapped. He distinguishes *H. loxense* from *H. cæspitosum* by italicized characters, most of which are rendered invalid by the fact that he takes his conception of *H. cæspitosum* from, or at least includes in his conception, *Leskea cæspitosa* of Hedwig, Spec. Musc. p. 233, t. 49. This, however, is far removed from the plant of Swartz, having much narrower, more acuminate leaves and bracts. I do not say it is not to be included in the "Formenkreis" of *R. cæspitosum*, but it is at the far extreme of the forms; if it is to be so considered there would certainly be no need for the present paper, for all the characters which have been held to separate the plants I am here uniting are of minute importance as compared with these two extremes. Apart from this consideration, then, C. Mueller's description of *H. loxense* gives no distinctive characters as separating it from *H. cæspitosum* that will stand cross-examination. He describes the leaf-margin of *H. cæspitosum* as "erecto vel vix reflexo," and that of *H. loxense* as "valde revoluto," but any stem of the plants under consideration will almost certainly show leaves with margins erect and others more or less strongly recurved or reflexed side by side on the same branch. The form of capsule indicates, it is true, some difference, which is certainly manifested on the actual plants, but it is not correlated with any other characters, and it depends to a considerable extent on the degree of maturity of the fruit when gathered. The African plants show a greater diversity in form of capsule, while preserving the other characters unimpaired.

Mrs. Britton and Mr. R. S. Williams have given some study to this group, and have a wide acquaintance with the South and Central American forms of *Rhaphidostegium*. Mrs. Britton writes, in answer to my enquiries, that they have not had an opportunity of studying the principal types, which are in Europe, but that they have given some attention to the group and been puzzled by their variations; she has considered that *R. loxense* and *R. galipense* differ from *R. cæspitosum* in having the leaves more secund and the perichætium more serrate. She adds that Mr. Williams has not seen the West Indian plant growing, but is inclined to recognize *R. loxense* as distinct, and relies on differences in the perichaetial leaves, and the amount of serration of the leaves.

It was clear that the only way to resolve the problem was to examine the types. Fortunately, most of these are to be found at Kew; Hooker's *H. loxense* is there in good material; there are two branches of Swartz's *H. cæspitosum* in Herb. Hooker; and Mrs. Britton has transcribed for me some notes and sketches made by Dr. A. Leroy Andrews from the type at Stockholm. There is also an original specimen of *H. lithophilum* Hornsch., and a large series of plants under various names from the West Indies and Tropical America.

As regards the perichætial leaves, these in *R. loxense* and *R. cæspitosum* types are absolutely identical. In neither are they denticulate; nor have I found anything amounting to denticulation in nearly all the forms I have examined; at the most they show an occasional obscure subdenticulation or sinuation. I have rarely indeed found the perichætial bracts in any species of *Rhaphidostegium* so constant as they are through the whole range of at least the more robust forms of this series of plants; only in one (*R. replicatum* Besch. from Réunion) have I seen them at all markedly denticulate. Bescherelle separates this species from *R. Duisaboanum* mainly on the ground of the perichætial bracts "fortement dentées"—in the diagnosis it is simply "denticulata"—but this condition does not occur on the type specimens in his herbarium, where they are often distinctly denticulate but no more, and often not that.

The direction of the leaves is certainly of no value; no series of these plants can be examined without finding every possible position, from perfectly equally imbricated to strongly homomallous, with no correlated characters; the types of *R. loxense* and *R. cæspitosum* are neither of them extreme forms, and that of *R. loxense* does not show the leaves very strongly homomallous; while there is a decided tendency to this direction of the leaves on one of the two branches of *R. cæspitosum* at Kew; and Dr. Andrews, in his notes on the type at Stockholm, writes: "Branches largely erect and not branching further, leaves falcate, secund." He also indicates the variability in the capsule form by describing them as "nearly as wide as long up to twice as long as wide."

The leaves show some variability as to acumination and as to erectness or otherwise of margin in both plants. The only point as to which there could be any question of difference, and that a minute one, is that the leaves in *R. cæspitosum* type show frequently, but not constantly, a minute close denticulation of the margin near apex. This, however, is not constant, and I have scarcely seen it on any other plant of *R. cæspitosum* that I have examined, at least as at all a constant character. No. 2113 of Mr. R. S. Williams's exsiccata of Bolivian plants, issued as *Sematophyllum cæspitosum* (Sw.), is instructive in this respect. It has many of the leaves finely denticulate as in the type, but at least an equal number on the same stem show no denticulation at all. Most of the West Indian and South American plants under this name show no denticulation whatever of the leaf-margin.

There is some slight variation in leaf form, in length of seta, and form of capsule. on the specimens, and as these variant forms occur on both plants they rather confirm than otherwise their identity. I do not doubt for a moment that an impartial examination of the two types, even without taking into consideration the various forms in which they occur in both their areas, would lead anyone to pronounce them identical, and I am inclined to think that the only cause that they have been so long kept apart is due to Hedwig's drawings and C. Mueller's description having led to *Leskea cæspitosa* of Hedwig being taken as representing the *H. cæspitosum* of Swartz.

My conclusions, after studying the types of *H. cæspitosum* Sw. and *H. loxense* Hook., as well as the original specimens of *H. lithophilum* Hornsch. and *H. Duisaboanum* Mont., can perhaps best be summed up by saying that except for the slight denticulation on the leaves of *H. cæspitosum*, and for some slight difference in the arrangement of the leaves on the branches, I should be exceedingly sorry for anyone who got the types mixed up and had to separate them again!

Having, as I think, established the identity of the two main groups of the South American plants, and their identity with the African *R. Duisaboanum*, I need scarcely labour the point further, but simply state that the Indian *Stereodon tristiculus* of Mitt. Musc. Ind. Or. p. 102 (which it may be noted was called *H. sphærotheca* by Wilson in sched.), of which I have examined the type, and the Australian *R. ovale* Broth., of which I have seen specimens of the original gatherings, are exactly identical with the plants already discussed. The species is, in fact, a practically cosmopolitan one throughout the tropical and subtropical regions of the Southern hemisphere, extending also into the temperate zone.

This point, however, having been reached, a much more perplexing one is to fix the limits of the species. In its more normal forms it is recognized at once by its robust habit and comparatively wide, and widely pointed—often, indeed, obtuse—leaves, very concave, with the margin usually more or less widely reflexed, especially where the leaf contracts to the apex; the erect, shortly and widely pointed entire or subentire perichætial bracts, the seta ranging round 1 cm. in length, but generally a little over, and the short, often turgid, capsule, with a more or less distinct neck, and usually suberect and only slightly asymmetrical, but often distinctly curved and sometimes horizontal or almost nodding. The areolation is often one of the most marked characters, the cells being rather short, with a linear-elliptic lumen, which in the broadly-pointed leaves often becomes much wider and shorter at apex, often quite widely and shortly elliptic, but is in most cases rendered more or less obscure and opaque by the cell contents or primordial utricle: the effect being a greyish appearance quite different from that of many species of *Rhaphidostegium*, where it is frequently chlorophyllous, elongate, and pellucid. This rather marked character, however, of areolation occurs in some other species which can hardly be included here, and its presence can therefore scarcely be taken as certainly indicating *R. cæspitosum*; while quite a number of forms which I cannot separate from that species show a very narrow and not conspicuously opaque areolation. Broadly speaking, the short wide type of cell is associated with a wide and widely pointed, even obtuse leaf, while the narrower and more acuminate forms show the narrow and less opaque cells.

It may reasonably be asked how a species supposed to embrace such extremes of leaf form is to be defined, and the difficulty must be admitted. At the same time, after examining many scores of specimens from all parts, I have only found one direction in which I have experienced any difficulty in defining the limits of the species. The perichætial bracts in *Rhaphidostegium* appear to me, as also in the allied genus *Sematophyllum*, to afford one of the most effective specific characters, and in *R. cæspitosum* these leaves, erect, not greatly differing in size but usually narrower than the stem and branch leaves, with rather broadly tapering, not very finely acuminate points, entire or nearly so, are fairly constant throughout the range of plants which I refer to *R. cæspitosum*. Add to this the short and turgid capsule, with a short but usually distinct neck, erect or slightly inclined, and usually slightly curved or asymmetric, not pendulous and very rarely horizontal, on a seta varying from ·7–1·5 cm. in length, and one has a combination of fruiting characters not found, I think, in any other species with at all the vegetative characters of *R. cæspitosum*. The difficulty that does occasionally arise is with the smaller and more slender forms, where both leaves and perichætial bracts tend to be narrower and more finely acuminate, with longer and more pellucid cells, usually correlated with a smaller capsule and shorter seta; and here it is certainly at times difficult to decide for or against their autonomy. *L. cæspitosa* Hedw. is one of these forms. In some of these cases the characters are purely ones of degree, and taxonomy becomes to a considerable extent a question of taste.

In the considerable list of synonyms I give below I have only made fresh reductions when I have been able to examine types or original or well authenticated specimens. A further number, to judge from the descriptions, especially of S. American species, will certainly have to be added, but however convincing the description (or poverty of description) may be, I have thought it better to omit all reference to those of which descriptions alone have been available. I append a few notes on some of the reduced species.

I have, after some hesitation, desisted from any attempt to group the various forms under varietal heads. The variations run on so many lines, and are so little correlated together, that it is practically impossible to classify the forms except on the basis of a single character, such as the form of leaf, the acuteness or otherwise of apex, and so on; and none of these appear to afford a basis for anything but a purely artificial classification. One of the most distinct forms is that represented by *R. Dicnemonella* (C. M.), where plants of a very small size are accompanied by an unusually obtuse, elliptical leaf with remarkably wide cells and very small sporophyte. Several of the African species which I have reduced come under this head, but I have also found the same leaf form in some South American plants not always associated with the same fruiting characters.

R. Kegelianum (C. M.), Surinam, Herb. Doz. & Molk., is the ordinary *R. cæspitosum*, the form with wide homomallous leaves and rather wide cells.

R. Sauloma (C. M.), Dusen, No. 87, is a form showing transition to the "*Dicnemonella*" form just referred to. This transition is still more clearly shown by *R. subcurvulum* (C. M.) Broth., coll. Zenker. *R. afro-demissum* (C. M.) is also certainly the same thing. C. Mueller, in fact, compares it with *R. cæspitosum*, and is only able to say for it that it is smaller with quite entire leaves, more laxly areolate, and smaller capsule. None of these characters would remove it from *R. cæspitosum* as understood in this paper. *H. Boswelli* Geheeb, ex Herb. Boswell, he adds, is very near it.

R. cæspitans Schimp., Guadeloupe, l'Herminier, Herb. Schimp., is a dense, robust, beautifully golden form, but structurally exhibits no differences.

R. agnatum (Hampe). This appears to be a very plastic plant. I first examined the type in Herb. Hampe, coll. Lindig (without number). This has rather narrow acuminate leaves, with elongate, rather pellucid cells, and perichætial leaves very finely filiform-subulate, like *L. cæspitosa* as figured by Hedwig. I concluded, therefore, that it must be distinct. Subsequently, however, I examined the specimen in Bescherelle's herbarium, No. 2135 coll. Lindig, and found that this was certainly only a small form of *R. cæspitosum*, with quite normal, widely-pointed perichætial bracts. I suspected a mixture, but on further examination I found that the two insensibly intergrade, and while the bulk of Lindig's plants show narrow and acuminate leaves, they pass insensibly into the form represented by No. 2135, and I even detected on Hampe's type a perichætium which was just half-way between the filiform pointed bracts prevailing there and the exactly *cæspitosum*-like bracts of No. 2135. *R. agnatum* must, therefore, be brought under *R. cæspitosum*, and with it one or two other species which Mrs. Britton has identified with *R. agnatum*.

R. cucullatifolium (Hampe), type, coll. Lindig. Might well be the type of *R. cæspitosum*, apart from the entire leaves, and might well have been collected on Table Mt.!

R. subsphæricarpum (Hampe & C. M.), type, coll. Glaziou. Has leaves rather narrowly acuminate and cells somewhat pellucid, but in all other respects agrees, and *R. pulvinale* (Hampe), also coll. Glaziou, forms an admirable connecting link.

R. Catillum (C. M.), coll. Schweinfurth, ex Herb. C. M. in Herb. Besch., shows a fine variety of leaf apex, within the limits of a single branch; many being rounded and quite obtuse, but others apiculate, or acute; on some branches the leaves are complanate, on others homomallous.

R. fluminale (C. M.), Cameroons, coll. Dusen, No. 665. Might well be the type of *R. loxense*!

R. perlaxum (C. M.), Cameroons, Coll. Dusen. Is simply a large lax form, such as occurs abundantly in S. American collections as *R. lithophilum*, &c.

R. inconspicuum (Hornsch.), Brasilia, Rio Grande, ex Herb. Martii, Herb. Hamp., is simply *R. cæspitosum*. The fruit is characteristic. C. Mueller's description in the Synopsis scarcely implies any difference from *R. loxense*.

Sematophyllum subnervatum Mitt. I have given this as a synonym without examination of specimens on the following grounds:—In the first place, Mitten had evidently been in two minds about raising it to the rank of a separate species, as he actually cites the type and only specimen on which it is based, under *S. cæspitosum*, only four pages earlier; and in the second place, because the only difference he suggests as separating it from *R. cæspitosum* is that the leaves are "superne angustiora."

So far, then, as I have been able to examine authentic specimens of the plants of this group, I propose the following synonymy:—

RHAPHIDOSTEGIUM CŒSPITOSUM (Sw.) Jaeg. Adumbr. ii. 454 (1875–6).

Hypnum cæspitosum Sw. Prodr. 142 (1788).

Leskea cæspitosa Sw. Fl. Ind. Occ. iii. 1807 (1806).

H. densifolium Spreng. et *H. pallidisetum* Brid. Bryol. Univ. ii. 591, *fide* C. M.

H. lithophilum Hornsch. in Mart. Fl. Brasil. i. 84!

H. loxense Hook. in Kunth. Syn. Pl. Æquinoct. i. 62!

Neckera straminea Hornsch. *op. cit.* p. 54 = *Leskea circinalis* Hampe, *fide* C. M. Syn. ii. 326.

Hypnum inconspicuum Hornsch. *op. cit.* i. 86!

H. subsecundum Arnott, Disp. d. M. 62, *fide* C. M.

H. obliquifolium C. M. in Bot. Zeit. 1845, p. 110, *fide* C. M.

Leskea Duisaboana Mont. in Ann. Sc. Nat. 1845, p. 97!

L. circinalis Hampe, Ic. Musc. t. 5!

Hookeria Leduceana Mont. Syll. p. 13, *fide* Besch. as var. *Leduceanum.*

Leskea subpinnata Brid. Bryol. Univ. ii. 289 = *Hyp. Kegelianum* C. M. *fide* C. M. Syn. ii. 325, et E. G. Britton in Bryologist, xxi. 28.

Hypnum galipense C. M. in Bot. Zeit. 1848, p. 780, *fide* C. M.

H. tovariense C. M. *loc. cit.*, *fide* C. M.

Leskea Kegeliana C. M. in Linnæa, 1841, p. 198!

Hypnum sphærotheca C. M. Syn. ii. 333!

H. Hampeanum C. M. Syn. ii. 326 = *Leskea circinalis* Hampe, *fide* C. M.

H. dissolutum Sull. in Proc. Amer. Acad. v. 289 (1861) = *R. galipense*, *fide* Jaeg.

H. admistum Sull. *op. cit.* 1861, p. 289 = *H. agnatum* Hampe, *fide* E. G. Britton *in litt.*

Stereodon tristiculus Mitt. in Journ. Linn. Soc., Bot. iii. Suppl., p. 102!

Hypnum cucullatifolium Hampe in Ann. Sc. Nat. sér. v. 1865, p. 328!

Sematophyllum lamprophyllum Mitt. in Journ. Linn. Soc., Bot. xii. 496 = *R. galipense*, *fide* E. G. Britton *in litt.*

S. leptothecium Mitt. *op. cit.* p. 482 = *H. agnatum* Hampe, *fide* E. G. Britton *in litt.*

Rhynchostegium Hampei Besch. Prodr. Bryol. Mexican. p. 105!

Hypnum Lecoultriæ Dub. Mem. Phyt. Soc. Genève, xxiv. 8, *fide* Besch.

H. Robillardii Dub. *op. cit.* p. 9, *fide* Besch.

Leucomium Robillardii Jaeg. Adumbr. p. 540.

R. replicatum Besch. Fl. Bryol. Réunion, etc. p. 158!

Rhaphidostegium cæspitans Schimp. in Besch. Fl. Bryol. Antill. Fr. p. 72!

Potamium homalophyllum Besch. Fl. Bryol. Antill. Fr. p. 52!

Hypnum aureolum Hampe in Vidensk. Medd. Kjobnhavn, 1877, p. 736!

H. pulvinale Hampe, *op. cit.* p. 735!

H. subsphæricarpum Hampe, *op. cit.* 1874, p. 523.

Rhyncho-Hypnum substrumiferum Hampe, *op. cit.* 1870, p. 286!

Sematophyllum subnervatum Mitt. in Journ. Linn. Soc., Bot. xii. 483.

Rhaphidostegium fallax Besch. Not. M. Paraguay, n. 270 (1877)!

Hypnum Catillum C. M. in Linnæa, 1875, p. 467!

H. afro-demissum C. M. in Abhandl. Brem. vii. 212!

H. leucostomum Hampe, Enum. M. Brasil, p. 81!

H. mundemonense Hampe, *op. cit.* p. 83!

Rhaphidostegium fusco-viride Besch. in Rev. Bryol. 1885, p. 19!

R. globosum Besch. *op. et loc. cit.*!

R. ovale Broth. in Œfv. af Finska Vet.-Akad. Förh. 1890, p. 107!

R. Barnesii Ren. & Card. in Bull. Soc. Roy. Belg. 1890, i. p. 182!

Aptychus longicollis Hampe ex C. M. in Bull. Herb. Boiss. 1897, p. 213.
A. semitortulus C. M. *op. et loc. cit.*
R. peralare Broth. in Engl. Bot. Jahrb. xx. 206!
Pterogoniella Stuhlmanni Broth. *op. cit.* p. 208!
R. perlaxum (C. M.) in Dus. M. Camer. et Par. Ind. p. 1102!
R. Dicnemonella (C. M.) Broth. in Engl. Bot. Jahrb. xxiv. 273!
R. Sauloma (C. M.) Broth. *loc. cit.*!
R. subcurvulum (C. M.) Broth. *loc. cit.*!
R. fluminale (C. M.) Broth. *op. cit.* p. 274!
R. chrysotis (C. M.) Broth. *loc. cit.*!
R glutinosum (C. M.) Broth. *op. cit.* p. 275!
Aptychus grammicarpus C. M. in Malpighia, 1896, p. 517!
A. concinnus C. M. *op. et loc. cit.* p. 275!

SCHRANKIA MICROPHYLLA.

By James Britten, F.L.S.

In the *Contributions from the Gray Herbarium*, lix. 9 (Sept. 1919) Mr. J. F. Macbride publishes "Schrankia microphylla (Dryand.) comb. nov." as the name to be substituted for the plant usually known as *S. angustata* Torr. & Gr. I had made the identification in a paper on "Smith's Georgian Plants" published in this Journal for 1898 (p. 301), which Mr. McBride has apparently overlooked, but had not made the combination—in those days many of us considered that the first name under the genus should be retained, and Dryander's description was published under *Mimosa*. It is, I think, evident that *S. microphylla* stands, but the circumstances connected with its publication are somewhat peculiar; and as the history which I gave (*l. c.*) has been somewhat amplified by further observation I will recapitulate here what is necessary of the former note and bring it up to date.

The description in the *Natural History of the rarer Lepidopterous Insects of Georgia*, ii. 123 (1797) is prefaced by Smith with the following heading and note:

"Mimosa microphylla Ait. Hort. Kew. ed. 2 ined. The plant in the plate is a species of *Mimosa*, which will appear in the second edition of the *Hortus Kewensis*, and for the following specific character and synonym of which we are obliged to Mr. Dryander."

Neither name nor description appears in ed. 2 of *Hortus Kewensis* (1813), but their place is supplied by *Schrankia uncinata* Willd. (Sp. Pl. iv. 1043; 1805) whose diagnosis is transcribed, with which Dryander subsequently identified his species. The history of the reduction is shown in the page of the Solander MSS. (xxi. 265) from which the description published by Smith was taken. Although Dryander was doubtless the *sender* of this, the MS. shows that Solander was the author both of the name and of the diagnosis; each was founded on a specimen from Bartram, in Banks's herbarium, which bears the name in Solander's hand. At a later period, Dryander practically rewrote the description, added synonymy, and identified the plant with *Schrankia uncinata* Willd., whose diagnosis he adopted, in Hort. Kew. ed. 2 (v. 256), where the plant is stated to have been introduced to the Garden by Banks in 1789. In the MS. Daybook of the Banksian Herbarium is an entry in Dryander's hand showing that the plant was sent from Kew to be named on Sept. 25, 1789 and was added to the Herbarium, where it now is; at the same time Dryander, on the sheet, substituted the name *uncinata* for the *microphylla* of Solander. From this somewhat lengthy account, which may not be altogether without interest as showing the historical value of the National Herbarium, it will be seen that although the name *microphylla* is, from the point of view of publication, correctly cited as "Dryand. ex Smith," its actual author was Solander. The reduction of *microphylla* to Willdenow's *uncinata* was also made by Smith in Rees's *Cyclopædia* (1815), anticipating that of Steudel (1821) cited in *Index Kewensis.*

How far *S. uncinata* and *S. microphylla* are distinct is a matter for closer investigation, especially of living plants, than I am able to undertake. So far as a fairly large series of herbarium specimens goes, I can see no sufficient differences between them; Dr. Britton diagnoses them as "leaflets elliptic, strongly veined" (*S. uncinata*) and "leaflets linear-oblong, scarcely veined" (*S. microphylla*), but I find in the National Herbarium a specimen labelled by him "*S. uncinata* Willd. so far as the leaflets go" which in general appearance corresponds with *S. microphylla* and was distributed by Rugel (no. 210) as "*Schranckia angustata* Torr. et Gray [=*microphylla*] sed foliis eximie venosa." The two are certainly, as Mr. Macbride says, "closely related"; it will have been noted that Dryander was convinced of their identity and that Smith also united them.

Walter's specimen of his *Mimosa Intsia* appears to belong to *S. microphylla*, with which Dryander (in Sol. MSS.) had already identified his description. The confusion with *Mimosa Intsia* L. dates back to Gronovius (Fl. Virg. 165: 1743), who unites the Virginia plant (Clayton, 416) with the description of the Linnean species in Hort. Cliff.; the same Linnean description is quoted by Gronovius in Fl. Virg. ed. 2, 81 (1762), against which (clearly referring to the Clayton specimen cited, which we have from Gronovius's herbarium) Dryander has written "microphylla"; his note in Sol. MSS. shows that he had observed Gronovius's mistake. Mr. Macbride rightly demurs to Mr. Trelease's invention of *Schrankia Intsia*, based as it is on the acceptance, without the slightest investigation, of Walter's misnomer: it is another example of the mischievous tendency to create new combinations on insufficient knowledge against which a protest was entered on p. 62 of this volume.

The foregoing remarks may be thus tabulated:

SCHRANKIA MICROPHYLLA Macbride in Contrib. Gray Herb. lix. 9 (1919).

Mimosa microphylla Soland. MSS. xxi. 265 et in Herb. Banks!; "Dryand." ex Sm. Georgia Insects, ii. 123 (1797).

Mimosa uncinata Dryand. in Soland. MSS. *l. c.*, et in Herb. Banks!

Mimosa Intsia Walt. Fl. Carol. 252 (1788) et Herb.! non L.

Schrankia angustata Torr. & Gray, Fl. Bor. Amer. i. 400 (1840).

SHORT NOTE.

Bedfordshire Plants.—Last June I met with a small patch of *Carex divisa* in a damp pasture by a foot-path in Woburn Park, about a quarter of a mile north of the Abbey. All the plants I saw were slender in habit, and appear to come under the var. *chætophylla* Kükenthal (*C. chætophylla* Steudel), but ripe fruit is needed to decide the point, and I did not gather the plant later in the year. This, so far as I am aware, is the first certain record for Bedfordshire; there is no mention of it in Abbot's *Flora*, nor by any subsequent writer on the plants of the county, and the sedge recorded as this from Flitwick Marsh some years ago turned out to be only *C. ovalis* (*vide* specimen in Herb. Mus. Brit.). Inland localities for *C. divisa* are rare—indeed, the British books do not indicate that it is ever found far away from the sea. It has, however, been recently gathered on the banks of the Thames between Putney and Barnes, and I have also seen specimens obtained in 1878 from near Hampstead Heath. In the *Flora of Middlesex* it is mentioned on the authority of L. W. Dillwyn as being plentiful in the Isle of Dogs. In West Gloucester it has been found in marshy pasture near the Wye at Beachley.—*Hypericum dubium* Leers. In the autumn of 1918 I saw two or three plants by the roadside near Little Brickhill, on the borders of Beds and Bucks. Abbot (Fl. Beds. p. 167) states that it was found by Mr. Vaux near Luton, but there is no subsequent record.—*Calamagrostis Epigeios*, a rare grass in Bedfordshire, was seen last year in some quantity by the side of a ride in the Woburn Evergreens.—A. Bruce Jackson.

REVIEWS.

Outlines of the History of Botany. By R. J. Harvey-Gibson, D.L., M.A. Demy 8vo, cloth, pp. x, 274: price 10*s.* net. London: A. & C. Black. 1919.

Few works on Botany could be more opportune at the present time than this handy volume, and all botanical students will be grateful to Professor Harvey-Gibson for finding the time, during a long period of war-work, for putting together such a charming collection of essays on the History of Botany, bringing the subject up to recent times.

The older standard work on the subject, that of Sachs (1875), although a classic in its day, stopped short at 1860, and hence fails to visualize the rapid extension of more modern Botany, notwithstanding the elegance of the English translation by H. E. Garnsey (1890); and has even become tedious to read in view of the prosy speculative and philosophical attitude of the older German writers, with whom it was more particularly concerned; while the prolix compilation of Reynolds Green (1909), written as a sequel to bring it up to 1900, also fails to supply the deficiency.

Professor Harvey-Gibson's work has the advantage of having been tried on a class of students, and may be said to be written from the standpoint of the rising generation, to whom discussion of such features as Evolution and Epigenesis, Spiral Theory and Metamorphosis, or effete systems of classification, have no meaning in view of the wider outlook available since the time of Darwin, with a more correct appreciation of what evolutionary morphology really consists in, as a further introduction to the general principles of systematy,

The new volume is concise, invigorating, and not too long. It is arranged in twelve chapters, each covering special ground; the last three being devoted to the more striking developments since 1900. Earlier chapters show a marked divergence from the standpoints familiar in Sachs's History, which after all was devoted more particularly to German literature since 1530, and showed a natural bias for the German School. Thus Theophrastus, as summing up the botanic ideas of the Greeks and older civilizations, all largely based on the isolation and cultivation of plant-types still of primary economic importance, is given much greater significance; though this may be partly due to the accessibility of the admirable translation of the Greek text by Hort (1916). A similar criticism—that Sachs had probably not taken the trouble to read the book—applies with equal force to the dawn of plant-anatomy, as represented by the remarkable volume by Nehemiah Grew (1682) emphasized in Chap. II. No special interest attaches to the evolution of systems of classification, when all were about equally wrong; and theoretical systematy could have little importance so long as the number and variety of forms described was insufficient to make any generalizations possible. Of the earlier English systematists Ray is preferred to Morison; the latter is even alluded to as a cantankerous person, though a glance at the volumes of his *Historia*, with their numerous copper-plates and coats of arms of the nobility who paid for them, is very illuminative of the indomitable perseverance of Morison and of his worries in publication; an encumbrance from which Ray was wholly free. The writings of the great Linnæus are also fitted into their just position as finishing off the book-work of his predecessors, and consolidating the foundations of the science without necessarily adding anything new; and similarly the "Natural System" of Jussieu (1789) is balanced by the even more significant observations of Sprengel (1795) on the relation between flowers and insects, as opening up one clue to what flowers really mean; as in other branches of the science Hales, Priestley, and Ingen-Housz were laying the foundation of the physiology of nutrition.

About one-third of the volume brings the subject up to the beginning of the nineteenth century, and now several great names in English Botany receive special attention, as Knight and Robert Brown; while it is interesting to get new and breezy estimates of the work of Schleiden, Von Mohl. and Hofmeister, who lead on to the epoch culminating in Darwin (1859), for whom the panegyric by Huxley (p. 135) is appropriately transcribed. Beyond the 'Origin of Species' we come to times within living memory, hence doubtfully of historical value; and the rapid extension of the science in every direction cannot be so readily placed in proper perspective. Such special departures as cytology and the study of nuclei, the problems of photosynthesis and metabolism of nitrogen, ascent of sap and even stelar theory, open up so many new vistas beyond the dreams of older schools, that the subject of Botany attains a wholly new connotation. In summing up some of the more important lines of development, the author ingeniously solves the problem by introducing lengthy quotations from authorities still living; and thus Bower is made responsible for views on the origin of antithetic alternation of generations (p. 179), Scott for the relation of Spermatophyta to Ferns (p. 257), and Hallier (p. 259) on the relation of Angiosperms to Bennettitæ.

The final chapters (since 1900) again emphasize equally new and striking aspects of the science, as the rise of Mendelism, and conclude with interesting pronouncements on the remarkable extension of Fossil Botany, Ecology, Energy Relations, and Sensitivity, as also the future systematy of Angiosperms. It must not be forgotten that the History of Botany includes not only the story of the progression of the human intellect in approaching the more intimate comprehension of a great and independent section of living organism, often with most imperfect tools; but is quite as much the record of human stupidity and perversity, adherence to preconceived ideas, theological, philosophical, and even in recent times zoological, anything rather than direct appeal to the living plant itself.

Even if one may not be always inclined to agree whole-heartedly with the author in estimates involving so many conflicting standpoints, it is a matter of congratulation that an English botanist can have opinions of his own, and does not mind printing them. Each lecture has a useful bibliography, restricted to papers which should be within the reach of students. A useful table expressing the parallel progression of the different branches of the science, in terms of the leading lights of the older and more modern world, would have been clearer if set up in type. The book is neatly got up; considering the enormous amount of digestible information, it is not expensive, and it is easy as well as delightful to read.

A. H. C.

Applied Botany. By G. S. M. Ellis. Pp. i–viii, 1–248. With 67 figures and 2 maps in the text. Hodder & Stoughton. 4*s.* 6*d.* net.

This beautifully-printed volume, neatly bound in dark-green cloth, is one of "The New Teaching Series of Practical Text-Books"—a series which, announces the wrapper, "is one of the first-fruits of the New Humanism, and breathes the inspiration of the hour's occasion: it strives to build up the New Humanism on the basis of the student's immediate economic interest and environment."

As to how far the volume before us realizes these lofty ideals we do not venture an opinion; but we can say without hesitation that Mr. Ellis has produced one of the best introductions to botanical science that we have seen. The title, however—devised, doubtless, to fall in line with the "New Teaching Series,"—is scarcely appropriate. An intelligent student of farming, having studied the book, might have some claim to a knowledge of the broad general principles of Botany, and be prepared to assimilate rapidly higher branches of the subject; but his studies would not help him to improve his crops by any application of his knowledge.

Mr. Ellis has, in a high degree, the enviable gift of a simple, very readable style. The sentences are short and well-balanced; the chapters end before the reader tires; he is reminded of Tyndall in his most juvenile vein. But the simple style is always attended by the risk of misleading, if not actually inaccurate, explanation. From the first page, for example, we learn that, by means of chlorophyll, green plants "are able to manufacture *from the air* the *food* with which to build up their tissues": and frequently through the first ten chapters "food" occurs when "carbohydrate-food" is correct. The essential idea of photosynthesis—*i. e.*, union by means of light, chemical combination of atmospheric carbon dioxide with soil-water by means of the radiant energy of the sun—cannot be insisted upon too early nor too clearly in a book which has for the title of its first chapter the ideal one of "The Living Plant."

The first five chapters deal principally with the water-factor; and the way is prepared, with admirable skill, for the elements of ecology, into which we find ourselves fairly launched in chapters vi, vii. In obedience, perhaps, to the student's "economic interest and environment," the next six are devoted to the soil alone. Chapter xiv, on "Cultivation and Manuring," approaches "Applied Botany" more nearly than any other section of the book; but it comprises only ten pages. In the next two chapters the subjects of Energy, Respiration, and Food are treated with remarkable skill and lucidity; they are followed by chapters upon Germination, Growth, and Movement; we could wish to see explained more clearly and at length the distinction between Monocotyledones and Dicotyledones in the matter of secondary growth and its relation to the morphology of the leaf and its base. Chapter xx, on Vegetative Reproduction, introduces budding and grafting: after a short chapter on "Some Simple Types," the remainder of the book is devoted to flowering plants, seed-dispersal, variation, evolution, and classification, treated in much the same way as in other elementary text-books.

The badly reproduced pictures are not pretty to look at; but they appear in most cases to be original, and illustrate precisely the points at issue and no more. What more can a picture do?

Altogether Mr. Ellis is to be congratulated upon the making of a valuable addition to the literature of Elementary Botany.

H. F. W.

BOOK-NOTES, NEWS, ETC.

When it was recognized, about three years ago, that there was no prospect of holding an International Botanical Congress in the near future, the Organizing Committee for the Congress which was to have been held in London in 1915 asked that their Executive Committee would re-open the matter of a Botanical Congress after the war, when the time seemed favourable. The Executive Committee have recently considered the possibility of holding in London a British Congress, at which botanists from the overseas dominions might meet their colleagues at home and discuss subjects of common interest. The programme would be wide, including the various applications of botany as well as the pure science. A circular letter sent to representative overseas botanists elicited replies in favour of holding such a Congress. The matter was considered at a meeting of British botanists at the Linnean Society's rooms on January 28, and a circular letter has also been sent to a number of botanists who were unable to be present at that meeting. In view of the somewhat divided opinion among home botanists as to the desirability of holding a Congress in the present year, and having in mind a suggestion from a prominent overseas official botanist as to the advisability of holding a British Botanical Congress simultaneously with the proposed British Empire Exhibition in September 1921, the Executive Committee have recommended postponement until that date.

The *Essex Naturalist* (xix. part 2; July 1919–Feb. 1920) contains an interesting paper by Mr. Percy Thompson "On an Annotated Copy of Richard Warner's *Plantæ Woodfordienses*." Mr. Thompson shows that the notes are in the hand of Benjamin Meggot Forster (1764–1829), whose plants are in the collection of his better-known brother Edward, now incorporated in the British Herbarium at Cromwell Road. The history of the volume is traced, and the MS. additions are printed, with facsimiles of two pages of Warner's book and two of B. M. Forster's letters; the whole is the result of full and careful investigation. The part also contains the conclusion of Mr. Miller Christy's paper on Samuel Dale, and a Presidential Address "On some Water-Plants" by Miss Lister—an excellent example of a paper which is at once popular, scientific, and of local interest. We note that *Alisma natans*" grows in more than one of the [Epping] Forest ponds, introduced probably by the agency of a botanist"—the same, it may be assumed, who was responsible for the introduction of *Actinocarpus* to various localities. Mr. Henry Whitehead has a note on the *Rubi* in the Essex herbarium. An account of the October fungus foray contains the description of a new species—*Marasmius obtusifolius* Rea.

We have received, somewhat late for notice, two papers published by M. E. L. Gerbault in the Bull. Soc. d'Agriculture Sciences et Arts de la Sarthe which should be of interest to British botanists. The earlier (1916) deals with *Sedum micranthum* Bast., which has been usually considered by British authors (Hooker, Babington, etc.) as a variety of *S. album*, but in Lond. Cat. ed. 10 was raised to the rank of a species. M. Gerbault shows that the two plants may be satisfactorily distinguished by habit, leaves, and flowers, and adds figures explaining the text. *S. micranthum* differs from *S. album* in being smaller in all its parts, by its more spreading dichotomy, its shorter blunter and less compressed leaves, more rounded sepals and more globular buds, smaller seeds, etc. In vol. xlvi. (1917–18) the author treats exhaustively of the forms of *Ranunculus repens*, of which he distinguishes six subspecies: *Bernardii*, *latifolius*, *Desportesianus*, *angustifolius*, *scriptus* and *reptabundus*—the last already described as a species by Jordan, lately admitted as British. Distinguishing characters are taken from habit, leaves, hairs, sepals, petals, nectaries and stamens; the author has gone very carefully into the more minute differential points, as to which the sketches and plates are of great assistance.—C. E. S.

Elementary Notes on the Reproduction of Angiosperms, by A. H. Church, M.A. (Oxford University Press; Botanical Memoirs, No. 5. 2*s.* net.), contains the schedules of ten lectures, each occupying the two sides of a page, which cover every aspect of the subject, the last lecture treating even of hybridization. Seldom have we seen so much information crowded into so small a compass; the "notes," in fact, would make an excellent *résumé* upon which to base an exhaustive detailed account, a volume of a thousand pages. "Cram-books"—and the one before us recalls analyses of Political Science and Paley's *Evidences* of ante-"Prelim." days—need an apology; and Dr. Church has provided one concluding his lecture-schedules, which he heads, significantly "Minimum Botany." The least we can say of this production is that we are inclined to envy the students who had the privilege of hearing Dr. Church's lectures.—H. F. W.

The Eleventh Report of the Botany Committee of the Devonshire Association for the Advancement of Science, edited by Mr. Hiern, contains an account of what has been published recently on the flora of the county in which the papers by Mr. C. P. Hurst and Miss Lister in this Journal for 1919 are summarised and the additions, including cryptogams, made by local observers for each district are chronicled. The Poppies and Violets of the Torquay district have received much attention, and Miss Larter records a curious form of *Cornus sanguinea* "with long drooping racemes formed by the gall *Oligotrophus Corni*; they had the appearance of ivory flowers depending from the stems."

Two years ago we quoted from the *Evening News* some verses on the Coltsfoot, as commemorating a plant whose praises were not often sung. The same justification applies in at least equal degree to the Groundsel, to whom the same author has now, in the same paper (Feb. 16), dedicated the following:

"The groundsel is a homely fellow
Who seldom gets his due.
Who cares if his small flag of yellow
Flies all the winter through?
He has no claim to strength or grace,
No subtle charm of form or face.

"But in this year of springtime wonder
Companions brave as he
Who push the prison bars asunder
And, daring to be free,
Attract all eyes and leave him more
Neglected than he was before.

"And is the groundsel, then, dejected?
No, splendid little chap,
'Tis only just what he expected,
He doesn't care a rap!
He is contented that he yields
The richest crop on fallow fields.
C. E. B."

"JOURNAL OF BOTANY" REPRINTS.

In view of the fact that the stock of these is in some cases practically exhausted, the attention of our readers is directed to the list which appears on the following page. Old subscribers of course already possess the matter contained in them in the pages of the *Journal*; but some of them appeared several years ago, and recent subscribers will thus not possess them. Some, which do not appear in the list, are already out of print; of others very few copies remain, and it will of course be impossible to reprint them: among the latter may be mentioned Mr. Jameson's *Genera and Species of British Mosses*, Mr. Riddelsdell's *Flora of Glamorganshire*, Mr. Dallman's *Notes on the Flora of Denbighshire* (1911), and Mr. Bennett's *Supplement to 'Topographical Botany*.' Of the Supplements to the *Biographical Index* no complete sets remain. It had been hoped before this to issue the second edition of the work, in which these Supplements are of course incorporated, but the present cost of paper and labour has rendered this impossible. Of the *Index* itself no copies remain, these having been lost in the course of transferring the stock to Messrs. Adlard. Mr. Garry's *Notes on the Drawings of Sowerby's 'English Botany*,' containing, as it does, much topographical information and numerous unpublished notes by Smith, Sowerby and others, should be in the possession of all interested in the history of British Botany: only sixteen copies remain.

It may be pointed out that, although for the most part relating to British Botany, certain of the reprints have a more general appeal. Such are the *Index Abecedarius*—a list of the plants in the first edition of Linnæus's *Species Plantarum*, showing at a glance what are included in that work, which has no index of species; the *History of Aiton's 'Hortus Kewensis*,' which contains much information as to the authors and contents of that classical work; the *Flora of Gibraltar*, which, besides a complete list, contains notes on the more interesting species; Linnæus's *Flora Anglica*—the first English Flora—has a bearing upon nomenclature: of all these there are numerous copies.

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THE

JOURNAL OF BOTANY

BRITISH AND FOREIGN.

EDITED BY

JAMES BRITTEN, K.C.S.G., F.L.S.

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THE JOURNAL OF BOTANY was established in 1863 by Seemann. In 1872 the editorship was assumed by Dr. Henry Trimen, who, assisted during part of the time by Mr. J. G. Baker and Mr. Spencer Moore, carried it on until the end of 1879, when he left England for Ceylon. Since then it has been in the hands of the present Editor.

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THE BOTANY OF THE MAROCCAN MIDDLE ATLAS.

By L. V. Lester-Garland, M.A., F.L.S.

In the summer of 1919 Captain Hubert Lynes, R.N., thanks to the assistance of General Lyautey, the Governor of French Marocco, was enabled to make a stay of ten weeks at Azrou, a *poste militaire* about 70 km. S.E. of Meknez, on the lower slopes of the Middle Atlas range. His first object was to study the birds, but he also made a collection of plants which he has kindly presented to the Herbarium of the British Museum (Natural History). In view of the inaccessibility of the Atlas owing to the hostility of the Berber tribes—even in the daytime Captain Lynes was not allowed to explore the neighbourhood without an armed guard—it seems desirable to publish a list of the plants which he brought home, some of which are of considerable interest.

The plants all came from what may be described as the middle zone of the range, between 4000 and 6000 feet. An account of the geology and topography of the district will be found in Captain Lynes' paper "On the Ornithology of the Maroccan Middle Atlas" in the *Ibis* for January, 1920. It must suffice here to give one or two of the main features. Immediately above Azrou there is an abrupt incline of about 2000 feet, which is more or less densely covered with forest. At about 6000 feet this is succeeded by a considerable plateau, the greater part of which is devoid of trees, but which is studded in places with "volcanic kopjes" on which Cedars grow and extinct craters which are richly clothed with vegetation. The plateau in places succeeds the forest zone abruptly; in other places there is an intermediate region of "barrens" and scrub. The slope consists chiefly of Jurassic limestone, the plateau "almost entirely of volcanic tufa and basalt."

The plants in the following list have been divided into four groups according to their distribution: (1) Those which reach Mid or even North Europe; (2) Widespread Mediterranean species; (3) "Local," *i. e.* those only found at the extreme west of the Mediterranean region; (4) Endemic in Marocco or the Atlas. The order followed is that of Engler and Prantl:—

Taxus baccata L. Edge of barrens, uncommon. (Mid Eur.)

Cedrus atlantica Manetti. 5000–6000 ft., abundant. (Endemic.)

Juniperus Oxycedrus L. (Medit.)

J. phœnicea L. Barrens, 6100 ft. A few trees. (Medit.)

Dactylis glomerata L., *Poa pratensis* L., *P. bulbosa* L., *Festuca arundinacea* Schreb.? Common on the plateau. (Mid Eur.)

Festuca indigesta Boiss. Plateau, 6200 ft. (Local.)

Haynaldia hordeacea Hackel. Plateau, 6200 ft. (Endemic.)

Tulipa Celsiana Redouté. Limestone, edge of upper forest. (Medit.)

Scilla hispanica Mill. Mid forest tapis. (Local.)

Ornithogalum umbellatum L. Plateau, (Mid Eur.)

Muscari neglectum Guss. Mid forest. (Medit.)

Gladiolus segetum Ker. Common up to 7500 ft. (Medit.)
Orchis mascula L. Forest, common. (Mid Eur.)
O. papilionacea L. ,, (Medit.)
Ophrys tenthredinifera Willd. (Medit.)
Rumex Acetosa L. forma. Forest clearings. (Mid Eur.)
Quercus Ilex L. Forest. (Medit.)
Cerastium arvense L. (Two forms.) Plateau. (Mid Eur.)
Eudianthe (*Silene*) *Cœli-rosa* Reich. var. *aspera* Poir. (Medit.)
Silene fuscata Link. Forest. (Medit.)
Dianthus virgineus L. Foot-hills and barrens. (Mid Eur.)
Pæonia corallina Retz. var. *coriacea* (Boiss.). Mid forest. (Local var.)
Ranunculus chærophyllus L. f. Plateau. (Medit.)
Sarcocapnos crassifolia DC. Rocks, locally abundant. (Local.)
Fumaria capreolata L. var. *albiflora*. Lower slopes. (Mid Eur.)
Biscutella frutescens Coss. Limestone rocks in upper forest. (Local.)
Iberis taurica DC. Mid forest. (Medit.)
Isatis tinctoria L. On tufa. Timadit volcano, 6200 ft. (Mid Eur.)
Arabis albida Stev. Upper forest. (Medit.)
Erysimum australe J. Gay. Plateau. (Mid Eur.)
Alyssum montanum L. Mid forest tapis. (Mid Eur.)
A. alpestre L. On limestone, 6100 ft. (Mid Eur.)
Reseda luteola L. f. Scoriaceous sides of Timadit volcano. (Mid Eur.)
Astrocarpus Clusii J. Gay. Volcanic rocks. Plateau. (Medit.)
Sedum album L. Upper forest. (Mid Eur.)
Saxifraga granulata L. var. *atlantica* B. & R. Forest. (Mid Eur.)
S. globulifera Desf. Rocks in upper forest. (Local.)
Ribes Grossularia L. Mid forest. (Mid Eur.)
Pirus torminalis Mill. ,, ,,
Cratægus monogyna Jacq. Abundant on the "barrens." (Mid Eur.)
Potentilla hispanica Zimm. Gorge in forest. (Local.)
Prunus prostrata Lab. Crater on the plateau. (Medit.)
P. Malaheb L. Upper forest. (Mid Eur.)
Genista ulicina Spach. Lower forest. (Endemic.)
G. pseudo-pilosa Coss. Abundant on the plateau. (Local.)
Cytisus Battandieri Maire. Among the cedars. (Endemic.)
Anthyllis vulneraria L. f. Upper forest edge. (Mid Eur.)
Astragalus (§ *Tragacantha*) sp. Timadit volcano. Abundant.
Coronilla valentina L. All altitudes. (Medit.)
Onobrychis sativa L. f. Barrens. (Mid Eur.)
Lathyrus (*Orobus*) *canescens* Gren. & Godr. Limestone in upper forest. (Medit.)
Vicia tenuifolia Roth. (Mid Eur.)
V. onobrychoides L. Forest. (Medit.)
V. erviformis Boiss. f. Forest, 4800–5700, ft., common. (Local.)
Geranium malvæflorum Boiss. Forest, common. (Local.)

G. molle L. (Mid Eur.)

Erodium mauretanicum Coss. & Dur. Ain Leuk, 5000 ft. (Endemic.)

Linum tenue Desf. Foot-hills, 4400 ft. (Local.)

Euphorbia nicæensis All. Volcanic kopje, 6200 ft. (Medit.)

Ilex Aquifolium L. Mid forest, abundant. (Mid Eur.)

Acer monspessulanum L. Upper forest. (Mid Eur.)

Pistacia Terebinthus L. Lower slope. (Medit.)

Malope malacoides L. (Medit.)

Malva Tournefortiana L. Lower slopes. (Local.)

Hypericum montanum L. Upper forest clearings. (Mid Eur.)

H. perforatum L. Foot-hills. (Mid Eur.)

Cistus laurifolius L. Upper clearings and kopjes. (Medit.)

Helianthemum glaucum Boiss. Common. (Medit.)

Halimium Libanotis Lange. Common in the forest. (Local.)

Tuberaria guttata Gross. var. *plantaginea* (Willd.). (Mid Eur.)

Lythrum flexuosum Lag. Forest. (Medit.)

Sanicula europæa L. Forest tapis. (Mid Eur.)

Anagallis linifolia L. var. *collina* (Schousb.). Forest clearings. (West Medit.)

Jasminum fruticans L. Lower forest. (Medit.)

Erythræa major Hoffm. & Link. Among *Ilex* scrub. (Medit.)

Convolvulus althæoides L. Open forest. (Medit.)

Cuscuta Epithymum Sm. Barrens: on *Thymus*. (Mid Eur.)

Cynoglossum cheirifolium L. Scoriaceous sides of Timadit. (Medit.)

Onosma echioides L. Scoriaceous sides of Timadit. (Mid Eur.)

Teucrium Polium L. var. Terrace, 4700 ft. (Medit.)

Nepeta reticulata Desf. Barrens. (Local.)

Salvia lanigera Poir. Forest. (Medit.)

Calamintha alpina L. var. *parviflora* Ball. Plateau. (? Endemic var.)

Thymus ciliatus Benth. Lower forest. (Local.)

T. hirtus Willd.? Plateau. (Local.)

T. zygis L. Lower slopes. (Local.)

Atropa Belladonna L. Upper forest clearings. (Mid Eur.)

Scrophularia canina L. Timadit volcano. (Mid Eur.)

Linaria heterophylla Desf. Upper forest and plateau. (Medit.)

Veronica rosea Desf.? Plateau.

Bartsia Trixago L. Lower slopes. (Medit.)

Galium lucidum All. Terrace. (Medit.)

Asperula hirsuta Desf. Forest. (Local.)

Sambucus Ebulus L. Forest. (Mid Eur.)

Viburnum Tinus L. Forest. (Medit.)

V. Lantana L. Mid forest. (Mid Eur.)

Lonicera implexa L. Lower forest. (Medit.)

L. arborea Boiss. Forest. (Local.)

Centranthus Calcitrapa L. Plateau. (Medit.)

Knautia arvensis Koch? Barrens. (Mid Eur.)

Campanula Trachelium L. Glabrous form. Mid forest. (Mid Eur.)

Trachelium angustifolium Schousb. Azrou mamelon. (Local.)

Bellium rotundifolium DC. Damp places in forest. (Local.)

Helichrysum lacteum Coss. & Dur. Plateau. Abundant. (? Endemic.)

Andryala integrifolia L. Lower slopes. (Medit.)

Achillea ligustica All. Mid forest glade. (Medit.)

Senecio giganteus Desf. By a stream. "Stem four inches in diameter." (Endemic.)

Centaurea pullata L. (Yellow flowers.) Open forest and plateau. (Local.)

C. axillaris Willd. Plateau. (Mid Eur.)

C. salmantica L. Volcanic kopje. (Medit.)

Kentrophyllum lanatum DC. Terrace. (Medit.)

Galactites tomentosa Manch. ,, ,,

Catananche cœrulea L. Esp. on volcanic kopjes. (Medit.)

Cichorium Intybus L. var. Terrace, among wheat. (Mid Eur.)

Perhaps the most remarkable feature of this list, so far as it goes, is the large proportion of species characteristic of the hill districts of Central Europe. Hooker and Ball noted the same fact in connection with the mountain flora of the Great Atlas further south. It may therefore be regarded as definitely established that there is a very close connection between the flora of the whole range and that of the hills and mountains of Europe.

The botany of the Lesser Atlas and the other mountain-masses of Algeria is pretty well known, thanks to the researches of Battandier and Trabut; and all the plants found by Captain Lynes, with the exception of nine or perhaps ten, are recorded by those authors in their *Flore de l'Algérie.* On the other hand, all we know of the flora of the Great Atlas is derived from Hooker and Ball's *Journal of a Tour in Marocco and the Great Atlas* (1878), and a collection of plants made by J. Thomson in 1888 which is preserved at Kew. Of the plants recorded in Ball's paper on "The Mountain Flora of Two Valleys in the Great Atlas" in Appendix G to the *Journal*, only 38 were refound by Captain Lynes in the Middle Atlas, and only 25 of Thomson's list. It should, however, be remembered that both Ball and Thomson were able to penetrate into the upper regions above 6000 feet, which Captain Lynes found it impossible to reach.

The following plants require a special note:—

Potentilla hispanica Zimm. This is the plant which Willkomm and Lange call *P. pennsylvanica* L., and has been recorded under that name from Southern Spain and Marocco. But Wolf in his Monograph of *Potentilla* has shown that this was a mistake, and that there are three related, but distinct, plants with different areas of distribution:—(1) *P. pennsylvanica* L. North America and East Siberia. (2) *P. sibirica* Wolf. Asia. (3) *P. hispanica* Zimm., which is found in South Spain (1500–1800 metres), and the mountains of Algiers, Marocco, and Abyssinia, with a variety in the Caucasus. The material at the British Museum and at Kew bears out his conclusions. It is a very showy species.

Cytisus Battandieri R. Maire (Récherches forest. Nord. Afr.

1915, p. 72, plate; Battandier, Contrib. Fl. Atlant. p. 25) is another remarkably fine plant with drooping racemes of large flowers and silvery leaves, of which no specimen seems to have existed in this country up to the present time. Captain Lynes informs me that it grows among the cedars and springs up in great quantities where there has been a clearing or after a fire.

Erythræa major Hoffm. & Link is a plant of the type of *E. ramosissima* Pers., but is distinguished by the larger, deeper-coloured flowers, with a longer corolla tube and more deeply-divided limb with acute segments. The anthers are exserted, and after dehiscence contract into a very elegant spiral coil.

Veronica ? rosea Desf. I have seen no specimen, and suggest the name with some diffidence; but judging from the description the plant appears to correspond very closely to what Battandier and Trabut understand by *V. rosea.*

BRITISH RUBI, 1900–1920.

By the Rev. H. J. Riddelsdell.

This paper is an attempt to summarize the changes in our ideas about *Rubus* (in Britain) which have taken place since Mr. Rogers published his *Handbook.*[1] In the majority of cases, the changes are directly due—so far as English botanists are concerned—to his work; the remainder have always been made under his guidance and with his consent.

My aim is simply to reduce these changes, most of which find their record in this Journal, to convenient shape for working purposes. Mr. Rogers some months ago kindly expressed complete approval of the plan, and indeed lent me his interleaved *Handbook*, which contains all the material and references here grouped. The paper, therefore, does nothing more than mention new forms, revisions of nomenclature and arrangement, corrections in description, and the like, belonging to the last twenty years. The distribution question is hardly touched. The tenth edition of the *London Catalogue*, of course, marks a stage in the process of development which is here sketched. There is nothing original in the paper, but it is hoped that it may enable workers in *Rubus*—now, alas, too few!—to carry on with greater ease.

The numbers referred to are those of the *Handbook*: any number followed by "*a*" indicate a species not in the *Handbook* and the position which it should hold in the list:—

6. R. PLICATUS Wh. & N. var. *hemistemon* (Genev.)=*pseudohemistemon* Focke. Journ. Bot. 1905, pp. 73, 199.

7. R. NITIDUS Wh. & N. subsp. *opacus* Focke becomes a full species. Journ. Bot. 1914, p. 180. In the description of sepals delete "*greyish-green.*"

9. For R. INTEGRIBASIS P. J. Muell. read R. CÆRESIENSIS Sudre & Gravet var. *integribasis* Rogers (non P. J. Muell.?). Journ. Bot. 1914, p. 179.

13. R. IMBRICATUS Hort. Add var. *londinensis* Rogers. See Journ. Bot. 1903, pp. 89, 90. It is the form of the Surrey commons mentioned at the end of the last paragraph (*Handbook*) under 13.

13 *a*. R. CASTRENSIS W.-Dod. Journ. Bot. 1906, pp. 63, 64.

14. R. CARPINIFOLIUS Wh. & N. The pan., when well-developed, often has a considerable ultra-axillary part, though rarely equalling a quarter of the whole.

15. R. INCURVATUS Bab. The cordate term. lt. is rare except in mature ls. of exceptionally strong plants: the term. lt. is more often entire or emarginate.

Add var. *subcarpinifolius* Rogers MS. This is the Upper Wye Valley form (see *Handbook*, p. 28): described in Journ. Bot. 1899, p. 194.

17. For R. ERYTHRINUS Genev., read R. ARGENTEUS Wh. & N. See Journ. Bot. 1905, p. 200.

19. R. RHAMNIFOLIUS Wh. & N. subsp. *Bakeri*. Add. f. *elongata* Rogers. See Journ. Bot. 1906, pp. 358, 9; 1891, pp. 240, 1.

20. R. NEMORALIS P. J. M. After var. *Silurum*, add var. or f. *cornubiensis* Rogers MS. *Ls. greenish-white* (and ? felted) beneath. Lts. plicate, convex. Pan. elongate, cylindrical. Ls. rather small, with more truncate and irregularly-toothed top. Pan. usually without simple floral ls., but with many short-stalked glands. Newquay district, N. Cornwall, abundant. See Journ. Bot. 1909, p. 174.

Var. *glabratus* Bab. "Pan. . . . less leafy above." For this, read "ultra-axillary part elongate cylindrical lax, usually without lanceolate simple leaflet at top, though lower down with 1 to 4 ovate or subrotund ones."

21. R. SCHEUTZII Lindeb. Stem is subglabrous or glabrous.

22. R. DUMNONIENSIS Bab. Add var. *cordatifolius* Rogers MS. See Journ. Bot. 1898, p. 86, and remarks in *Handbook*, p. 32 (on Channel Island form). This var. has a pan. with 1 or 2 simple ls. with deeply cordate base.

24 *a*. R. LACUSTRIS Rogers. See Journ. Bot. 1907, p. 9.

26. R. VILLICAULIS Koehl. Subsp. *Selmeri* and subsp. *rhombifolius* are both given specific rank.

Add. var. *megastachys* W.-Dod (of *R. rhombifolius* Weihe). See Journ. Bot. 1906, p. 64.

27. R. GRATUS Focke. Panicle irregular, dense above, lax below, often fairly cylindrical at first.

Add var. *sciaphilus* Lange; it is the Slesvig plant described in *Handbook*, p. 37. Found by Ley in Breconshire and Herefordshire.

30. R. THYRSOIDEUS Wimm. Add var. *viridescens* Rogers MS. Journ. Bot. 1909, p. 174, B. E. C. Rep. 1904, p. 17, Wats. E. C. Rep. 1917–8. Leaves *greener*, *narrower*, soon bare beneath. *Term. lt. cuspidate-acumte*, somewhat *obovate*, nearly parallel-sided, often cordate. *Pan.* strongly branched, with wavy rachis, *large ultra-axillary part*, and *strong falcate prk*. Pet. *purplish*.

31. For R. ARGENTATUS P. J. Muell. read R. GODRONI Lec. & Lam. See Journ. Bot. 1905, p. 201.

Add var. *foliolatus* Rogers & Ley. Journ. Bot. 1906, p. 58.

35. For *R. myricæ* Focke var. *hesperius* Rogers read R. HES-

PERIUS Rogers. Now treated by Focke as a distinct species. Journ. Bot. 1914, p. 181.

35 *a*. R. CHLOROTHYRSUS Focke. Journ. Bot. 1914, p. 207. Derbyshire.

38. R. QUESTIERII Lefv. & Muell. Delete last sentence; the Co. Down form is now described as *R. Lettii* Rogers.

42. R. ORTHOCLADOS Ley. Stem is hairy or subglabrous, polished. On the suggested hybrid origin of *R. orthoclados*, see Journ. Bot. 1914, pp. 181, 2.

43. For R. MICANS Gren. & Godr. read R. HYPOLEUCUS Lefv. & Muell. Journ. Bot. 1905, p. 202.

44. R. HIRTIFOLIUS Muell. & Wirtg. For var. *danicus* (Focke) read var. *orbifolius* (Lefv. exs.) Boulay in Rouy & Cam. Fl. Fr. vi. 22: for var. *mollissimus* (Rogers) read var. *subcanus* P. J. Muell. in Boulay, Ronc. Vosg. p. 34, No. 27 (1866). Journ. Bot. 1914, p. 204.

45. R. IRICUS Rogers. Add var. or f. *minor* Rogers MS. Stem densely hairy. Lts. rather small and narrow, with nearly parallel sides and more deeply incised irregular teeth towards the point. Pan. narrower, much less robust, and more nearly pyramidal in outline, usually considerably glandular above. See Journ. Bot. 1910, p. 318.

47. R. LEUCOSTACHYS. Read "Sm. (not Schleich.)."

For var. *gymnostachys* Genev. read *macrothyrsus* J. Lange. Journ. Bot. 1914, p. 203.

48. R. LASIOCLADOS Focke var. *longus* Rogers & Ley. Journ. Bot. 1906, p. 58.

Before 49 add [R. EGREGIUS Focke] var. *plymensis* Focke, var. nov. Near Plymouth. Journ. Bot. 1914, p. 204.

49 *a*. R. LETTII Rogers. Journ. Bot. 1901, p. 381.

53 *a*. R. MUCRONATOIDES Ley. *Handbook*, p. 55, l. 8 from bottom. Journ. Bot. 1907, p. 446.

55. R. ANGLOSAXONICUS Gelert subsp. *vestitiformis*. Read "Prk. many, unequal, rather scattered." Note: remarkable for its range of variation from type *anglosaxonicus* to *leucostachys*. Usually (much) nearer to the latter in general aspect, though with different armature and flowers and rather less hairy stem.—W. M. R., Sept. 1913.

56. For R. MELANOXYLON Muell. & Wirtg. read R. FURVICOLOR Focke. Endemic. Journ. Bot. 1914, p. 206.

60. R. DREJERI G. Jensen var. *hibernicus* Rogers. Delete "roundish" in description of term. lt.

Add var. *dunensis* Rogers. Journ. Bot. 1901, pp. 382, 3. This covers the "more strongly-armed allied forms" of *Handbook*, p. 63.

61. R. RADULA Weihe subsp. *sertiflorus* (P. J. Muell.) is removed to the sub-Koehleriani as a subspecies of *R. ericetorum* Lefv.; see Journ. Bot. 1906, p. 59. The "nearly allied form in 3 Scottish Counties" (*Handbook*, p. 64) is var. *scoticus* Rogers & Ley. (Journ. Bot. 1906, p. 60) placed also under *R. ericetorum*.

64. R. OIGOCLADUS. For "Muell. & Lefv. ?" read "Rogers." It is not Muell. & Lefv.'s plant. Journ. Bot. 1914, pp. 205, 6.

Var. *Newbouldii* is of Rogers, not of Bab. Journ. Bot. 1905, p. 364.

Var. *Bloxamianus* Colem. Delete "rather short" in description of panicle.

67 *a*. R. PRÆRUPTORUM Bab. (not Boul.?): see *Handbook*, p. 69, l. 4 from top.

68. R. MELANODERMIS Focke. Delete "short" in description of panicle branches.

69. R. BABINGTONII Bell-Salt. Remove var. *phyllothyrsus* (Frider).

69 *a*. Add R. FESTIVUS Muell. & Wirtg., which covers some of the plants formerly put under *phyllothyrsus* (Frider). Journ. Bot. 1914, p. 207.

70. R. LEJEUNEI Wh. & N. var. *ericetorum* (Lefv.) is made a species. Under it are placed var. *cuneatus* Rogers & Ley., subsp. *sertiflorus* (P. J. Muell.) and its var. *scoticus* Rogers & Ley. Journ. Bot. 1906, pp. 59, 60.

72. R. MUTABILIS Genev. Add var. *Naldretti* White. Journ. Bot. 1908, pp. 24, 59. Wats. E. C. Rep. 1906–7.

Between 75 and 76 comes *R. glareosus* Rogers & Marshall. Journ. Bot. 1912, pp. 309, 374. Mr. Rogers's re-arrangement of species there proposed is not here reproduced, because it is absent from his interleaved *Handbook*, and apparently was not brought into practical use by him when he was in active work.

79. R. LONGITHYRSIGER Bab. var. *botryeros* Focke is raised to specific rank.

81 *a*. R. HORRIDICAULIS P. J. Muell. Journ. Bot. 1906, p. 60.

84. R. KOEHLERI Wh. & N. subsp. *dasyphyllus* Rogers is made a full species. It is not endemic: Mr. Rogers has seen specimens from Denmark.

92. On R. HIRTUS Waldst. & Kit. var. *minutiflorus* (P. J. Muell.). Mr. Rogers (1914) notes "Perhaps it had best be omitted from our British list."

93. R. ACUTIFRONS Ley. Add var. *amplifrons* Ley. Journ. Bot. 1902, p. 69.

98. R. DUMETORUM Weihe. Between *ferox* and *britannicus* add var. *triangularis* Ley. Journ. Bot. 1902, p. 70.

Before *tuberculatus* add var. *raduliformis* Ley. Journ. Bot. 1904, p. 120.

99. R. CORYLIFOLIUS Sm. For var. *cyclophyllus* substitute var. *conjungens* Bab.

Add form c, *calcareus* Rogers MS.; distinct from both (a) *sublustris* and (b) *conjungens*. *Stem uniformly angled* and more conspicuously so than in *conjungens*, though slenderer than in either *a* or *b*. *Prk.* as in *b with stout base*, but usually fewer and more strictly confined to angles. L. 5-nate. *Term. lt. ovate-acuminate, narrow*, with close finely-pointed teeth as in *a*, but neither lobate towards point nor cleft at base. Usually wholly eglandular.

Apparently the prevailing corylifolian in the Cotteswolds, from about 200′ to over 700′ alt., between Cheltenham eastward to Kingham, and Aston-sub-Edge southward to Foss Cross. Further observations in other limestone districts may be necessary for decision as to its value as a distinct form or var. Connected by a few intermediates with *a* and *b*.—W. M. R., 1913.

TROPICAL AMERICAN RUBIACEÆ.—XIII.

By H. F. Wernham.

(Continued from Journ. Bot. 1919, Supplement (*Manettia*).)

The Genus Coupoui.

At the end of his *Histoire des Plantes de la Guiane Françoise* (1775), Aublet adds a supplement, and with the expressed purpose of including therein ". . . . . plantes dont on n'a pu se procurer des caractères complets." The very nature of this arrangement should inspire a certain confidence in the author's descriptions; but the result has been very different, as the sequel shows, in the treatment of the genus *Coupoui*, described for the first time on pp. 16, 17 of this supplement and figured in plate 377.

The conspicuous tree ("arbor procera") upon which Aublet founded this new genus was generally familiar enough locally a century ago to have a name in the Caribbean vernacular—*Coupoui-Rana*; the first part of this Aublet adopted for the generic name. He describes the vegetative parts—form, branches, wood, bark, and leaves—with the care with which so many of his genera were founded and have borne the test of subsequent research. The flowers, he tells us, he has never seen—"je ne l'ai point vu en fleur." The fruit he describes in detail, in Latin and in French:—"sa forme approchoit de celle d'un citron . . . . couronné par cinq lobes du calice. Il ne renfermoit qu'une seule amande. Il étoit en fruit dans le mois de Mai." Aublet found it growing on the banks of the Galibi river, and so he named the species *C. aquatica*. He offers no suggestion as to its affinities, generic or otherwise.

It was left to John Miers to associate flowers with this plant, more than a century later. Miers found Aublet's type—consisting of two of the very characteristic leaves, detached—in the National Herbarium; and he matched them, accurately it would seem, with specimens collected by Martin at the end of the eighteenth century in Guiana, now preserved in the same herbarium. These latter bear leaves and flowers clustered together at the extremity of twigs, all arising apparently at one transverse level.

In his *Apocynaceæ of South America* (1878) Miers introduces a genus *Cupirana* (p. 15). This, he says, "is the *Coupoui* of Aublet, who figured the plant and unripe fruit only, which is represented as if crowned with a superior calyx—*a mistake originating in the inversion of the detached drupe.*" Miers offers no kind of evidence to support the all-important statement that I have italicised; but, after pointing out that, as a result of this "mistake," most botanists had referred this genus to *Myrtaceæ*, he draws the entirely unwarranted conclusion that "its true place is unquestionably "in *Apocynaceæ*, as I have ascertained by flowering specimens of the same plant collected in Cayenne by Martin."

It is clear that the flowers of this plant were unknown to the leading systematists in the interval between Aublet and Miers; all accepted the description due to the former. The genus is unnoticed throughout the Linnean literature. Lamarck (Encycl. Méth. ii. 147 (1786), gives a condensed account, based entirely upon Aublet's descriptions; both the Gaertners (DC. Fruct. 1788–1805) leave *Coupoui* without mention, despite the careful description of the fruit available; so also A. L. de Jussieu (Gen. Pl. 1789). In the *Prodromus* (iii. 295, 1828) De Candolle includes *Coupoui* among his "Myrtacæ dubiæ," with the remark "Flores ignoti." Bentham and Hooker were the first systematists to guess the family to which this genus seems rightly to belong—*Rubiaceæ*; and in the absence of flowers their determination amounts to little more than a guess—as witness their erroneous suggestions of its affinities within the family in question. Thus Bentham (*Gen. Plant.* i. 696, 1865) removes *Coupoui* from Myrtaceæ and relegates it to *Pentagonia*, in the group *Catesbœeæ* of *Rubiaceæ*—a tribal affinity inadmissible on the ground of fruit-characters alone, apart from the sex-separation and the æstivation of the corolla.

Miers's treatment of Aublet's nomenclature is more than drastic and, to modern ideas, is unpardonable. He alters both names, generic and specific, advancing reasons that seem altogether inadequate (*op. cit.* 16). *Coupoui*, he fears, might be confounded with *Coupeia*, *Goupia*, and *Cupia*, so he proceeds to create real confusion by naming the genus *Cupirana*, i. e. "wild" Cupi, "to distinguish it from the true Cupi (*Couepia guianensis*)"—a distinction of which the necessity was unsuspected previously. "Aublet's specific name," continues Miers, "is not adopted, as it presupposes (*sic*) a small aquatic plant." Baillon, in his *Histoire des Plantes*, x. 176 (1888), restores the name *Coupoui*, and includes the genus among doubtful *Apocynaceæ*, following Miers's account without making any personal research or comment.

In the matter of nomenclature Rafinesque, in his *Principes fondamentaux de Somiologie, etc.* (1814), was more merciful than Miers. On page 29 of this interesting work he enunciates a "*Règle.*—Quand la terminaison des noms génériques est barbare, il faut la modifier. . . . . *Obs.*—Ainsi il faut écrire . . . *Cupuia* au lieu de *Coupoui*. . ."

In all the circumstances it would seem best to follow Baillon in adhering to the original Aubletian name, leaving any change for a future Botanical Congress; *Coupoui* appears to be no more "barbaric" than many other names that still stand without question.

I have examined the flowers of Martin's specimens referred to above; and, apart from their superficial appearance and contorted corolla-lobes, there is little reason to associate them with *Apocynaceæ*. Above all, the sexes are separated—a rare, if not unrecorded, condition in the last-named family. I have found no female flowers, unfortunately, upon any of the *Coupoui* specimens that I have seen; all are staminate, with sterile female parts at most. Moreover, all these male flowers are hexamerous; Miers, in his generic description, wrongly describes them as pentamerous—"corollæ . . . . . limbi segmenta 5 . . . . . stamina 5 . . . . ." In fact, hexamery appears to be a character constant for the male flowers of all the species; while from Aublet's description of the fruit, it would seem that the female flowers are pentamerous (op. cit. 17—"couronné par cinque lobes du calice"). An isomery as between male and female is a condition by no means unusual in the case of declinous flowers.

The inferior fruit and sympetalous corolla point clearly to *Rubiaceæ* as the family to which *Coupoui* may be assigned; and this conclusion is supported by the whorled arrangement of the simple leaves, with their entire margins. The fruit is fleshy, apparently, containing a single large seed; but in spite of the last-named character, it would seem that *Coupoui* should be relegated to the multiovulate section of *Rubiaceæ* (see Wernham in Journ. Bot. liv. 326 (1916)). The diœcism, the contorted æstivation, and the external aspect of the plant leave little doubt that the genus is related to *Duroia* and other allied members of the tribe *Gardenieæ* in which the sexes are separated—constituting the subtribe *Cordiereæ*. The buds of the male flowers in *Coupoui* bear a striking resemblance to those in *Amajoua*, *Duroia*, etc. Moveover, the *Eugardenieæ* display a decided general tendency to reduction in the number of ovules and seeds, correlated, probably, with the tendency to increased size of the latter: many species of *Tricalysia*, for example, and its allies *Diplospora*, *Kraussia*, etc., have fruits with few seeds—from three to one. This tendency, however, has not been noted in the *Cordiereæ* hitherto, so that *Coupoui* is readily definable as a genus upon this character alone. Other critical characters are the arrangement of the male flowers in many-flowered clusters, and of the female, two or three together terminally upon the twigs ("bini aut terni, subsessiles, terminales," according to Aublet); and the whorled arrangement of the leaves, with the fugacious stipules.

Miers described a second species of his *Cupirana*, based upon another plant of Martin's collection, and a third, collected in the Para district of Brazil by Ducke, is described below. It is remarkable that this should have escaped the notice of Brazilian collectors prior to the present century; *Coupoui* has no place in the *Flora Brasiliensis*.

The genus, then, comprises three species, all in the National Herbarium, readily distinguishable by the following clavis:—

Leaf-stalks much exceeding the flowers; leaf-base auriculate-cordate .... *aquatica*.
Leaf-stalks not exceeding the flowers, or barely so; leaf-base acute.
  Calyx-limb truncate, entire .... *Martiniana*.
  Calyx-limb conspicuously toothed .... *brasiliensis*.

1. COUPOUI AQUATICA Aublet, Pl. Guian. ii. Supp. 16, t. 377 (1775). *Cupirana Aubletiana* Miers, Apoc. S. Amer. 15 (1878).

GUIANA. Galibi river, French Guiana, *Aublet*! Cayenne, *Martin*!

2. COUPOUI MARTINIANA Wernham, nom. nov. *Cupirana Martiniana* Miers, Apoc. S. Amer. 17 (1878).

GUIANA. Cayenne, *Martin*!

3. **Coupoui brasiliensis** Wernham, sp. nov.

Arbor, ramulis validissimis subteretibus insigniter corticatis apicem versus foliorum deciduorum cicatricibus ca. 5-natim verticillatis dispositorum onustis conspicuis. *Folia* magna subcoriacea, elliptico-lanceolata v. oblonga, apicem obtusum brevissime apiculatum versus vix acuminata basi acuta fere cuneata, supra glaberrima subpolita subtus in venis primariis necnon reticulo interveniente manifesto minutissime strigillosa aliter glabrata, *venis* primariis subtus prominentibus lateralibus utrinque 17–20 marginem parallelis leniter curvantibus nonnunquam inter se anastomosantibus, petiolo longiusculo supra anguste necnon altiuscule canaliculato minute etsi dense puberulo-strigilloso; *stipulæ* caducæ post delapsum lineam alto sulcatam relinquentes interpetiolarem. *Flores* majusculi umbellis cymosis dispositi sessilibus v. subsessilibus petiolos manifeste brevioribus, pedicellis conspicuis glabratis calycem demum longitudine excedentibus graciliusculis; *calycis* tubus tubulari-infundibularis magnus extus breviter necnon notabiliter sericeus, dentibus acutissimis conspicuis lineari-lanceolatis coronatus; *corollæ* extus sericeæ tubus latus anguste infundibularis lobis brevior ovato-lanceolatis acuminatis acutissimis.

BRAZIL. Para, Rio Tapajoz, région des Cataractes inférieures: nom. vulg. *puruy*. *Ducke* 16872! Forêt entre Armina-mirein et Tiramba, Rio Trombetas, *Ducke* 11463!

Leaves about 40 cm. long, 18 cm. broad; petiole 6 cm. or more in length; primary lateral veins, 18 pairs. Floral pedicels nearly 3 cm. in length, with average transverse diameter of 1·5 mm. at most. The calyx consists of a narrowly funnel-shaped tube over 1·5 cm. long, rather more than 1 cm. wide at the mouth, crowned by 6 very short, but conspicuously sharp, teeth. The corolla-tube, 1·7 cm. or longer, broadens, somewhat, from a diameter of about 4 mm. at the base to 8 mm. or more at the mouth; the spreading limb of the corolla measures about 5 cm. in diameter, each of the six lobes being about 2·3 cm. long and 7–10 mm. broad just below the middle.

LICHENS OF LLANBERIS AND DISTRICT.

By W. Watson, D.Sc., A.L.S.

The list of lichens given by Mr. Wheldon in the January number of this Journal (pp. 11–15) is a useful one, but, as the author remarks, cannot be regarded as exhaustive. In 1915 I spent a week in the district and last year (shortly after Mr. Wheldon's visit) a fortnight, and I am thus able to add a few notes to the above-mentioned list.

The inclusion in the list of *Lecanora epanora* was useful to me, as it brought to my notice that a plant which I overlooked as a sterile form of *L. sulphurea* was this much rarer plant. Some of the plants in the list, e. g. *Cladonia uncialis* f. *obtusata*, *C. lepidota* f. *hypophylla* (which I think descends from *C. cervicornis* or *C. degenerans*), and the "unexpected" *Cerania vermicularis*, were recorded from the Snowdon district in this Journal for 1917 in my papers on

"New Rare or Critical Lichens." *Bæomyces roseus*, which Mr. Weldon only saw in a sterile condition, was observed with abundant apothecia on the side of the path leading from Llanberis to Helfa. Most specimens of *Lecidea lapicida* I examined gave a yellow reaction with potash, and are therefore referable to *L. polycarpa* Flk.

The following are additions to Mr. Wheldon's list, and also to those recorded from the district by me in the papers already mentioned. Where no locality is given Llanberis must be understood.

Thermutis velutina Th. Fr. On damp precipitous rocks from Glyder, overlooking Pass. Only a few apothecia were seen.

Ephebeia hispidula Nyl. Cwm-y-glo.

Collema ceraniscum Nyl. Moist rocks overlooking Pass. Rock ledges, Clogwyn. *C. pulposum* Ach. Rare, on mortar of house, Hebron. *C. cheileum* Ach. On walls, Dinorwic.

Leptogium scotinum v. *sinuatum* Malbr. *L. lacerum* Gray, not common; var. *lophæum* Nyl. Beddgelert; var. *pulvinatum* Krb. On mortar and surrounding rock with *Placynthium nigrum Callopisma rupestre, C. calvum*, and *Physcia cæsia.*

Pannaria nebulosa Hoffm. On wall-top, Pass.

Massalongia carnosa Krb. Frequent, 400 to 2000 ft.

Peltigera rufescens Hoffm. and *P. polydactyla* v. *hymenina* Nyl. are frequent.

Solorina saccata Ach. In addition to the stations given, this was noticed at Clogwyn, Glyder (3200 ft.), and Beddgelert.

Stictina fuliginosa Nyl. and *S. limbata* Nyl. Cwm-y-glo and Beddgelert.

Coniocybe furfuracea Ach.

Sphærophorus compressus Krb. Snowdon, 3000 ft. *S. coralloides* form *congestus* Lamy. Common.

Ramalina calicaris Fr., *R. farinacea* Ach., and *R. fastigiata* Ach. are rather frequent, especially near Cwm-y-glo. *R. subfarinacea* is occasional.

Parmelia subconspersa Nyl. On wall near Llanberis Church. *P. omphalodes* f. *cæsiopruinosa* Nyl.

Usnea florida Web. Llanberis and Baddgelert.

Alectoria nigricans Nyl. Near summit of Glyder Fawr with *Parmelia corniculata, P. pubescens, Cladonia gracilis* form *amaura, C. degenerans* f. *pleolepidea* and *C. lepidota* f. *hypophylla* near it.

Placodium murorum DC. On wall.

Callopisma citrinum Krb. On mortar and surrounding rock. *C. ferrugineum* v. *festivum* Mudd. On hard rock near Llanberis waterfall.

Lecanora subfusca Nyl., *L. intumescens* Krb., *L. pallida* Schær., and *L. conizæa* Nyl. are occasional on trees. *L. campestris* Nyl. is apparently rare. *L. intricata* Ach. On rock near Hebron. *L. gangaleoides* Nyl. and *L. subtartarea* Nyl. On rock, Snowdon, 2500 ft. *L. umbrina* Mass.

Hæmatomma ventosum Mass. Snowdon.

Pertusaria communis f. *rupestris* DC. *P. wulfenii* DC., *P. dealbata* f. *corallina* Cromb. Snowdon, 2500 ft.

Urceolaria scruposa Ach. Walls, Nant Peris.

Umbilicaria pustulata Hoffm. Fairly common.

Gyrophora proboscidea Ach. and f. *fimbriata* Mudd. Snowdon, 1600 ft.

Bæomyces rufus v. *prostii* Harm. On rock near Llanberis waterfall.

Icmadophila æruginosa Trév. Snowdon, about 2500 ft.

Cladonia pyxidata v. *pocillum* Fr. Rare. *C. gracilis* v. *hybrida* Schær. *C. squamosa* v. *polychonia* (Flk.), *C. subsquamosa* Nyl.

C. furcata v. *spinosa* Hook., v. *palamæa*, Nyl. Beddgelert. *C. rangiformis* Hoffm. Llanberis and Beddgelert. *C. coccifera* v. *pleurota* Schær. Glyder. *C. flœrkeana* f. *brachypoda* Nyl. Not uncommon on peaty ground, Snowdon. *C. sylvatica* f. *grandis* Oliv.

Lecidea granulosa f. *viridula* Cromb. *L. sorediza* Nyl. *L. protrusa* Fr., *L. latypea* Ach. *L. contigua* f. *calcarea* Leight. On rocks, Bwlch-cwm-Mas, var. *platycarpa* Fr. Snowdon. *L. leucophæoides* Nyl. and *L. griseoatra* Schær. On boulders 2000 ft. Snowdon. *L. parasema* v. *elæochroma* Ach. Frequent on trees.

Biatorina lenticularis v. *erubescens*. On rocks near Llanberis waterfall.

Bilimbia sabuletorum B. & R. Frequent on decaying bryophytes on walls; var. *obscuratum* A. L. Sm. Nant Peris.

Bacidia inundata Krb. On rocks by the side of Llyn Peris. A dark form from the same locality agrees fairly well with *B. caligans* A. L. Sm.

Buellia æthalea Ach. On rocks near waterfall, Llanberis.

Rhizocarpon alboatrum v. *epipolium* A. L. Sm. *R. obscuratum* Mass. *R. geographicum* v. *atrovirens* Krb. *R. confervoides* f. *dispersum* (Leight.). On rocks near Llanberis waterfall.

Opegrapha atra Pers. and v. *denigrata* Schær.

Graphis elegans Ach. Cwm-y-glo. *G. scripta* Ach.

Dermatocarpon miniatum Th. Fr. Llanberis, Snowdon, Glyder; v. *complicatum* Th. Fr. and f. *decipiens* A. L. Sm. On damp precipitous rocks from the Glyder, near Pass. *D. lachneum* A. L. Sm. Clogwyn, Snowdon.

Verrucaria æthiobola Wahl. In stream, Llanberis and Y Garn (2500 ft.). *V. submersa* Schær. In stream. *V. maculiformis* Kremp. Frequent on slaty rocks, Llanberis, Dinorwic, Bwlch-cwm-Mas.

Thelidium microcarpum A. L. Sm. On wall of old house, Hebron.

Acrocordia biformis Oliv.

Arthopyrenia fallax Arn.

Pyrenula nitida Ach.

Botrydina vulgaris Bréb. Common.

NORWEGIAN EUPHRASIAS.

Die Euphrasia-Arten Norwegens von E. Jörgensen. Bergens Museums Aarbok 1916–17: Naturvidenskabelig række nr. 5. pp. 337, 11 maps, 14 plates, 54 figures in text. Bergen: John Griegs, 1919.

Of this paper the following is an abstract:—

In common with the rest of the European species, the Norwegian Euphrasias belong to Bentham's section *Semicalcaratæ*, which is thus divided:

Subsection I. *Angustifoliæ* Wettst.
Contains only *E. salisburgensis*.
Subsection II. *Ciliatæ* Jörg.
Capsulæ margine longe ciliatæ.

Series 1. *Minoriflorœ.* Corolla small, 7 mm. long or shorter: *E. latifolia*, *E. minima*, *E. scotica*, *E. micrantha*, *E. curta*, *E. nemorosa*, and *E. cærulea*.

Series 2. *Majoriflorœ.* Corolla 8 mm. long or longer: *E. brevipila*, *E. tenuis*, *E. stricta*, *E. suecica*, *E. borealis*, *E. atlantica*, and *E. hyperborea*.

Series 3. *Grandiflorœ.* Corolla 10 mm. long or longer: *E. rostkoviana*.

The following key to the species is an abbreviated form of that given by the author:

A. Glands stalked.
  I. Glands numerous.
    a. Glands short; flowers large, corolla 8 mm. or longer, often shorter; bracts awned; corolla-tube during flowering at least 1 mm. long .... *E. brevipila* (early summer form *E. tenuis*).
    b. Glands long, relatively small-headed; bracts not clearly awned; corolla-tube during flowering about 1·5 mm. long .... *E. rostkoviana* (early summer form *E. montana*).
  II. Glands very few, short.
    a. Large-flowered, similar to *E. latifolia* in northern Norway .... *E. hyperborea.*
    b. Small-flowered .... *E. latifolia.*
B. Stalked glands absent except sometimes on corolla.
  I. Flowers large, corolla 8 mm. or longer.
    a. Late summer forms.
      1. Fruiting calyx not (or little) enlarged with long narrow teeth........................ *E. stricta*, subsp. *eustricta.*
      2. Fruiting calyx sometimes much enlarged with large broad teeth .... *E. borealis*, subsp. *subbrevipila.*
    b. Early summer forms.
      1. Corresponding to *E. stricta*, subsp. a, *E. suecica.*
      2. Corresponding to *E. borealis*, subsp. a, *E. atlantica.*
      3. Similar to *E. latifolia.* Leaves and bracts with a more or less wedge-shaped base. *E. hyperborea* in northern Norway.
  II. Small-flowered. Corolla 7 mm. long or longer.
    a. Capsule either without hairs on the edge or with only short hairs .... *E. salisburgensis.*

b. Capsule with numerous hairs on the edge.
- 1. Fruiting calyx almost smooth.
  - Plants of a purplish colour or dark green.
    - Under-lip longer than the upper. Late summer forms .... *E. micrantha.*
    - Under-lip about as long as the upper. Moor forms.
      - Western hill plants .... *E. scotica.*
      - Alpine plant .... *E. minima*, var. *palustris.*
  - Green or golden green. Corolla only 3·5 mm. In Northern Norway .... *E. latifolia*, var. *inundata.*
- 2. Fruiting calyx more or less strongly hairy.
  - Early summer types. Seeds large, 1·5–2·0 mm. long. Alpine or northern plants.
    - Capsule elliptical .... *E. minima.*
    - Capsule narrow, oblong, large. In northern Norway .... *E. latifolia.*
  - Late summer type. Seeds small, about 1 mm. long. Only in plains and generally hairy .... *E. curta.*

The monograph is in German with the exception of a short summary of the primary points discussed in English on pp. 317–327. It is remarkable that the common British *E. nemorosa* is very doubtfully Norwegian. In the key, *E. gracilis* Fries=*E. micrantha* Reichenb.
E. G. B.

SHORT NOTES.

Alchemilla acutidens in England. (See Journ. Bot. 1914, 281.) Late in June 1919, during an expedition in the Grassington district, Yorkshire, accompanied by Messrs. S. Cryer, T. J. Foggitt and J. W. White, I noticed a peculiar-looking *Alchemilla* which did not seem happily placed under *A. alpestris*, although that seemed its nearest ally. The locality would be at an elevation of about 900 feet between Grassington and Conistone. A week or so later Mr. E. G. Baker gathered, in the same neighbourhood, somewhat similar examples. In the meantime, on July 7th, the late Anthony Wallis and I spent a day exploring the lower slopes of Cross Fell and were rewarded by finding a number of interesting plants of which I hope to give an account later. At an elevation of between 1500–1600 ft. a small patch of an *Alchemilla* was found on a wet ledge of rocks, growing with *A. alpestris*, but which, even at first sight, proclaimed itself to be undoubted *A. acutidens.* The low-growing habit, the stems decumbent at the base, the peculiarly glaucous leaves with acute and ± regular teeth, and the pronounced hairiness of the plant showed us that there could be scarcely a doubt as to its name. Upon careful examination at home, I found the leaf-outline matched well that figured in this Journal (*l. c.* 284, f. 2) and noted that the deep sinus between the lobes of the lower foliaceous bracts were often remarkably pronounced—a good distinction, seemingly, between this species and *A. alpestris.* Our examples grew upon the Westmoreland portion of the mountain, but I have little doubt a longer search would reveal its presence upon the same hill further west in the county of Cumberland.

Since writing the above I have had an opportunity of submitting a parcel of Alchemillas to Prof. Lindberg in Finland. He unhesitatingly determines as *A. acutidens* the Cross Fell gathering; of the Grassington plant he says "I believe that this beautiful plant is a form of the very variable *A. acutidens*," and he considers Mr. E. G. Baker's specimens as that species. Prof. Lindberg also confirms as *acutidens* my naming of a plant gathered in 1914 by the late E. S. Marshall on Beinn a Chroin, Glen Falloch, West Perth, at an elevation of about 2500 ft.

According to the map given by Lindberg (Nord. *Alchemilla vulgaris*-formen; Act. Soc. Sci. Fenn. xxxvii. No. 10, Pl. 13, 1909), the Yorkshire locality is some 270 miles further south than that at which *A. acutidens* occurs in Scandinavia; although away in the East it is known from Tula, Russia (S. of Moscow), nearly on the same degree of longitude as Grassington.

A. acutidens var. *alpestriformis*, to which I refer the British plant, may thus now be placed on record for v.c. 64, Mid west Yorkshire!; v.c. 69, Westmoreland!; and v.c. 87, West Perthshire! (or 87½ Lomond, as suggested by Mr. Barclay in this Journal for 1915, p. 250).—C. E. Salmon.

Some Records. Mr. Bennett has kindly confirmed my naming of a *Callitriche* from E. Gloster: it is *C. polymorpha* Lönnr. I gathered the specimen in 1909 in the low ground north of Chipping Campden, not far from the county border. *C. obtusangula* Le Gall. grew in the same spot. Mr. Bennett also names a plant from Fairwater, v.c. 41, *C. vernalis* Koch = *C. palustris* L.—My herbarium contains specimens of *Zannichellia gibberosa* Reichb., from Deal (1901), and Welsh St. Donat's, v.c. 41 (1904), of *Z. pedunculata* Reichb., from Oxwich (1897) and Aberafan (1904) v.c. 41.—Among my Potamogetons are *P. zosterifolius* Schum. f. *major* Zapalowicz, from Derbyshire (Purchas, 1884), *obtusifolius* Mert. & Koch, Groby Pool, Leics. (T. Kirk, 1851), *Friesii* Rupr., from both v.c. 33 & 34, the probable hybrid *Friesii* × *pusillus* from v.c. 34, *panormitanus* Biv.-Bern., Llyn Coron, v.c. 52, *flabellatus* Bab., and *pectinatus* L. from both v.c. 33 & 34.—*Eleocharis uniglumis* Schultes was sent me in 1917 from Swansea Bay (v.c. 41): and I have *Carex Leersii* F. Schultz, from v.c. 33 & 34, *C. Pairæi* F. Schultz = (*C. muricata* L.) from v.c. 33 & 41, *C. divulsa* Stokes, from v.c. 33 & 34, *C. gracilis* Curt. var. *personata* Fr., & var. *prolixa* (Fr.) v.c. 33 & 34, *C. flacca* Schreb. var. *aggregata* Reich., v.c. 33, and a curious form akin to both *binervis* and *distans* from v.c. 33. The naming of the majority of these is due to Mr. Bennett.—H. J. Riddelsdell.

The Mild Season. The following are among the more noteworthy of early flowering-plants in the Bristol district during this remarkable season. By January 18 some of the Wych Elms in Clifton were already in blossom. On Feb. 12 I saw *Hutchinsia petræa* flowers, and a few young capsules, on seedlings half an inch high. By March 3rd some two dozen umbels of *Smyrnium* were in flower and a few in young fruit by the Avon, immediately below the suspension bridge. Early in March a friend at Clevedon reported *Lathræa*. On the 12th *Thlaspi alpestre* was seen by H. Corder near Sidcot, Somerset. On March 20, by a road-side in Clifton, a small Lime tree was green with leaves, already 1¼ inch across; other Limes in the neighbourhood have not burst their leaf-buds, except a short row of young pollard trees which are beginning to do so. Silver Birch catkins are now (March 21) showing their stamens; and a Mountain Ash (*P. Aucuparia*) has leaves of five inches and good racemes of flower-buds; a young Ash (*Fraxinus*) has been in blossom some days. Shoots of White Bryony are from one to two feet long in a thicket on Clifton Down. Near Axbridge, below the sunny slope of Mendip, the vegetation is particularly remarkable. On March 20 *Lithospermum purpureo-cœruleum* shoots were quite advanced, and several in a secluded spot only a hundred feet above sea-level had their red buds just waiting to open and turn ultramarine: May until the end of June is the usual flowering-time. Near by were *Fragaria vesca*, two plants in blossom, Bluebell heads already blue, Garlic with well-developed leaves and unopened spathes 1¾ inch long, Melic-grass with flowering-shoots a foot high and practically "out," *Cerastium arvense* (very rare in Somerset) in bud, and flowers of *Potentilla verna* spotted the ground of an upland slope with yellow. I have no record of such precocious flowering during my residence in the West of England prior to 1889, nor again during the past six years.—H. S. THOMPSON.

ROSE RECORDS. Col. Wolley-Dod has recently been so kind as to name a large number of Roses from my collection. They were gathered in various counties, chiefly in Gloucestershire. One group of them have a special interest, for they were the last roses gathered by Mr. Ley (1910). They had gone to Dingler, who owing to ill-health was obliged in 1911 to return them without working at them. The most interesting records are the following: Glamorgan, v.c. 41; *Rosa erronea* Rip., *Reuteri* Godr., *dumetorum* var. *sphærocarpa* (Pug.), and *omissa* Déségl.—Northants, v.c. 32 (all Ley's): *R. jactata* Déségl., *Carionii* Déségl. & Gill., *Rothschildii* Druce, *insignis* Déségl. & Rip., *hemitricha* Rip., *trichoneura* Rip.—Hunts, v.c. 31 (Ley's), *R. ramealis* Pug.; and Radnor, v.c. 43 (Ley's), *R. subcristata* Baker.—Hereford, v.c. 36 (mostly my own gathering), *R. stenocarpa* Déségl., *tomentella* var. *obtusifolia* Desv., *dumetorum* near var. *spinetorum* (Déségl. & Ozan.), *Déséglisei* Chr., *incerta* Déségl.—E. Gloster, v.c. 33, *R. omissa* Déségl., *tomentosa* Sm. var. *confusa* (Pug.), *mucronulata* Déségl., *senticosa* Ach., *Lemaitrei* Rip., *eriostyla* Rip., *nemophila* Déségl. & Ozan., *micrantha* var. *trichocarpa* Rouy, *Carionii* Déségl. & Gill.—W. Gloster, v.c. 34, *R. omissa* Déségl., *tomentosa* Sm., *transitoria* R. Kell., *sphæroidea* Rip., *dumalis* Bechst., *syntrichostyla* Rip., *Rousselii* Rip.. *verticillacantha* Mér., *Lemaitrei* Rip., *senticosa* Ach., *mucronulata* Déségl., *incerta* Déségl., *sphærocarpa* Pug., *urbica* Chr., *Reuteri* and its var. *subcristata* Baker, *Carionii* Déségl. & Gill., *systyla* f. *leucochroa* (Desv.).

H. J. RIDDELSDELL.

ASTRANTIA MAXIMA Pall. IN DURHAM. During a botanical holiday spent by us in Upper Teesdale, in July 1919, my sister (Mrs. C. L. Wilde) discovered this species on the wooded slopes of a beck near Middleton-in-Teesdale, v.c. 66, to all appearance quite wild.

There were some hundreds of plants, with at least fifty or sixty flowering-spikes, massed in an area of several square yards. Mr. C. E. Salmon, who confirms the determination, informs me that it is a non-European species, a native of Caucasia, Trans-Caucasia and Armenia, and it consequently must have been introduced. Both my sister and I feel reasonably certain that it was not deliberately planted, and no non-European trees or shrubs were observed in the woods. The nearest houses are about two hundred yards above, on the edge of the wood, and are of the usual small industrial type. I should not have considered the species sufficiently decorative for garden purposes, but it is included in Cassell's *Dictionary of Gardening* and Robinson's *English Flower Garden.* I have never seen it in cultivation, neither has Mr. Salmon. Mr. G. C. Druce informs me that *A. maxima* was recorded from Scotland as a planted alien in the Bot. Exch. Club Report for 1908.—E. B. Bishop.

REVIEW.

Sveriges Rosæ. By S. Almquist. Stockholm, 1919.

In this work the author presents the results of his lifelong study of roses in the form of a remarkable work involving an entirely new classification of the genus *Rosa*, based chiefly on the form and serration of the leaflets of the flowering shoots. Whilst studying the different sections of *Rosa Afzeliana* Fr. (=*R. glauca* Vill.+*R. coriifolia* Fr.), the author found that there were types of species running through all, or most, of the groups of roses. These types include species belonging to different groups, but nevertheless essentially alike in the form and serrations of the leaflets, the prickles, colour, etc. Each special type normally displays two species, one having leaves with a well-developed waxy "bloom" and the other with the bloom more or less weakly shown; each of these species in turn may occur with smooth and with hairy leaves.

According to the author the total number of such special types is 31, yielding in Sweden 224 species; to determine them a concise key illustrated by clear line-drawings is provided, and a synoptic tabular statement of groups and types shows very clearly the relationship of the species.

Naturally enough, the catalogue of the Swedish species occupies the greatest part of the book; nevertheless, in the account of the types and their distribution, many foreign species are named.

Amongst the novelties of classification one notes that *R. coriifolia* Fr. and *R. dumetorum* Thuill are regarded merely as single species of the *acutiformis* and *cuneatula* types. Further, all species with subfoliar glands (other than on the midrib), usually assigned to the *Afzelianæ* or *Caninæ*, are transferred to the *Rubiginosæ* and *Agrestes*; with the same groups are also classified species such as *Jundzilliana*, *rhætica*, *uriensis*, *tomentella*, etc., sometimes treated by other authors as forming special groups. *R. rubrifolia* (auct.) (the oldest name of which, *R. glauca* Pourr., is reinstated) is separated from the *Afzelianæ* and, following De Candolle, inserted amongst the *Cinnamomeæ.* In this latter group and that of *Pimpinellifoliæ* are included several species variously placed by others; these are *R. lævigata*, *R. chinensis*, *R. carolina*, *R. bracteata*, *R. microphylla*, *R. Banksia*, etc. Strangely enough, in these cases forms with subfoliar glands are allowed to stand as usual.

For the most part the system is carried through strictly on the above-mentioned natural principles which ought to yield a simple and clear treatment as the types constitute the tie uniting the groups; this naturally means a large number of new names which, in the case of the Swedish species, are supplied by the author and R. Matsson. A few old names are retained, which must be employed in the restricted sense demanded by Almquist's scheme.

The drawings are so careful that it would seem relatively easy for the trained eye to determine the types by their aid; nevertheless, difficulties soon arise owing to the great breadth of variation seen at all points when details are investigated.

According to Almquist the geographical distribution of the various types is greatly different; some are Holarctic, others are Palæarctic, whilst still others are confined to Europe. Even in Europe some are western and some eastern; one, indeed, is confined to Scandinavia.

At this stage the author provides many facts of great interest, *e. g.* he mentions that in the Færoe Islands *R. pimpinellifolia* is replaced by semi-villosan *R. færoensis*, which he regards as a mutant of the former; *R. orientalis* is similarly a semi-villosan. *R. pimpinellifolia* Almquist looks upon as a juvenile species, inasmuch as its leaves are not further advanced than the stage of an "*a*" leaflet, whilst the stem bears the prickle armature of a normal second-year shoot of other roses.

Sveriges Rosæ is an important contribution to the literature of the genus *Rosa*; one can easily forsee that its new revolutionary opinions as outlined above will provoke criticism, and thus by their very novelty stimulate a new and fruitful study of the genus, thereby necessitating a revision of names as employed by previous authors.

A full index and all the named species and subspecies add to the value of the work.

CARL TRAAEN,
Staback, Norway.

[We are indebted for this notice to Dr. J. W. Heslop-Harrison of Armstrong College, Newcastle-on-Tyne, to whom it was forwarded by the author for publication in this Journal. Dr. Harrison has rendered the translation somewhat more idiomatic, but otherwise the review is as it was sent. Dr. Harrison writes: "Almquist's views agree closely with mine derived from an intensive study of the genus from the genetic standpoint. The '*a*' leaflet referred to above is the lowest one of the flowering shoot in Almquist's nomenclature; to quote his exact words 'På alla fig. betyder '*a*' och '*b*' nederblad på blomskottet, '*c*' mellanblad, '*d*' och '*e*' overblad.'"—ED. JOURN. BOT.]

THE SHAMROCK.

As St. Patrick's Day comes round, the newspaper botanist usually enlightens his readers with his views about the Shamrock: this year, however, he has surpassed himself in the ingenuity and inaccuracy of his conclusions. The palm must be given to the *Daily News*, which had already (Feb. 25) distinguished itself by tha following paragraph relating to the "Blue Primrose," of which the writer seems now to have heard for the first time:—

"Among the exhibits yesterday at the Royal Horticultural Society was the blue primrose, a flower recently discovered by Mr. Wilson, the famous plant cultivator, and double primroses were shown closely resembling the purple lilac in colour. A flower related to the English cowslip, namely, the Italian primrose, was also on view. When the wind blows over the Italian hills, whereon this flower grows, the leaves, which are dappled, ruffle, and suggest to the onlooker a cloud burdened with snow."

On March 19 the following paragraph appeared in the column headed "Under the Clock," in which from time to time appear many things "hard to be understood" in so far as they relate to facts.

"There was a fair amount of shamrock worn in London yesterday, or, rather, the common clover which passes for shamrock. This plant is now quite common in Ireland, and I received a small box of it from Cork yesterday morning labelled "Shamrock from Ireland." But it was not shamrock at all. Genuine shamrock is the beautiful little wood-sorrel, the trefoil leaf of which is a brilliant green, and which bears a geranium-like white flower. The clover which has usurped the place of the traditional shamrock has no flower [!], and the four-leaf variety is quite common."

Comment upon this would only spoil it: an attempt to correct some of its absurdities resulted in the following (March 20):—

"There are, it seems, at least four possible claimants to the honour of being the real thing: White (or Dutch) clover, Black medick, Wood Sorrel, Lesser yellow trefoil. I gather that the last holds the field, and can be tested at the right time of year by its yellow flowers, but wood sorrel has a kind of semi-official claim. The famous four leaves may happen on any of these varieties, I believe."

How the shamrock is to be "tested by its yellow flowers," and what is "the right time of year" for applying the test, the writer does not say, but it is satisfactory that he has discovered that it *has* flowers.

The *Westminster Gazette*, usually better informed, announced (Mar. 17) that, "botanists believe that the genuine shamrock is the wild wood-sorrel." Against this aspersion a protest was sent, in which it was pointed out that general as well as local testimony identified the shamrock with *Trifolium minus*, as evidenced by the *Dictionary of English Plant-Names* and by the late Nathaniel Colgan's exhaustive paper on "The Shamrock in Ireland," to which reference is made on p. 118. This, however, was combatted (Mar. 19) by a correspondent who rehashed the farrago of inaccuracies given in the unfortunate "popular" portion of Syme's *English Botany*, and, supporting the claims of the wood-sorrel—first propounded, as Colgan points out, by Bicheno in 1830–31,—stated that, "ancient writers all agree that the shamrock was edible, and the wood-sorrel has been eaten in Ireland from time immemorial!" A correction of these and other misstatements appears in the *W. G.* for March 23, and there that paper leaves the matter, anticipating (no doubt correctly) that "the discussion will break out again, somewhere about the middle of next March!"

BOOK-NOTES, NEWS, ETC.

The *Irish Naturalist* for Nov.–Dec. 1919 contains a biography, with portrait, of Nathaniel Colgan, whose death occurred on Oct. 2. He was born in Dublin on May 28, 1851, and at an early age obtained a clerkship in the Dublin Metropolitan Police Court, from whose services he retired in 1916. Interested in general literature, Colgan took up botany in 1880, and later made the acquaintance of A. G. More, Mr. Lloyd Praeger—the writer of the notice referred to,—and Mr. R. W. Scully: his first botanical contribution was a note on *Saussurea alpina*, printed in this Journal for 1885 (p. 157). In 1894 Colgan published his *Flora of the County Dublin*, and in 1898, in conjunction with Mr. Scully, the second edition of the *Cybele Hibernica*, based on the papers of More, who died in 1895 and by his will appointed the two botanists to complete the work and see it through the press: both of these volumes are admirably done; the introduction to the former contains much useful biographical information. Colgan contributed numerous papers to the *Irish Naturalist* and some to this Journal; among the latter may be noted those on the occurrence of *Artemisia Stelleriana in Ireland* (1894) and—in the same volume—a paper on "Henry Mundy and the Shamrock" which was subsequently embodied in his exceedingly interesting and exhaustive account of "The Shamrock in Literature" published in Journ. R. Soc. Antiquaries of Ireland for 1896. He took part in the Clare Island Survey set on foot by the Royal Irish Academy in 1909, in whose Proceedings he published an account of the plant and animal names in use in the island, with their associated folk-lore.

At the meeting of the Linnean Society on March 4, a communication was brought before the Society entitled "A Contribution to our Knowledge of the Botany of New Caledonia" relating to the collection made by Mr. R. H. Compton in New Caledonia and the Isle of Pines during 1914. The specimens collected have been presented to the British Museum, and the greater part have been worked out in the Department of Botany. Since his return, Mr. Compton has been appointed Professor of Botany in the Cape Town University, and Director of the new Botanic Gardens at Stellenbosch. Dr. Rendle gave a short account of the position and physical characters of the island; and referred to previous work on its flora, and its general characters. Important features are the igneous rocks which form a mountain chain of gneiss in the north-east, and the serpentine formation which covers the southern portion and occurs in larger or smaller areas throughout the island. The climate is mesothermic; the rainfall is relatively abundant, but owing to evaporation and the porous nature of the soil, many parts of the country have an arid appearance. The flora is rich, and the proportion of endemic forms exceptionally high. The relative proportions of the different families of flowering plants in the present collection are very similar to those recently worked out by Mr. Guillaumin for the flora as a whole, the four families which contain the highest number of species being in each case *Euphorbiaceæ*, *Rubiaceæ*, *Orchidaceæ*, and *Myrtaceæ*. The main affinities of the flora are with Indo-Malaya and South-East Australia, the former represented chiefly in the forest regions and the latter in the scrub and savannah regions; and a study of it suggests that New Caledonia is a very ancient land mass which has been isolated for a very long period.

In common with all kindred bodies, the Linnean Society has had to face the altered condition of affairs created by the War, and with a view to meeting the emergency the Council has suggested certain measures which were submitted to the meeting of the Society on March 18 and adopted. The most important of these is the increase of the annual subscription from £3 to £4: the decision of the Council was arrived at with reluctance, but the economies already adopted, including the suspension of the *Transactions*, have proved inadequate to meet the growing expenses.

The *Flora of the District of Columbia and Vicinity*, by A. S. Hitchcock and Paul C. Standley, "with the assistance of the botanists of Washington" forms Vol. 21 of the Contributions from the U.S. National Museum. It consists of a series of keys—the first to the families, based mainly on vegetative characters, followed by one based mainly on floral characters; under each order is a key to to the genera and under each genus a key to the species followed by a list with notes as to habitat, distribution, etc. "The nomenclature is in accord with the American Code of Botanical Nomenclature, except that so-called duplicate binomials are not used": some of the names will be unfamiliar to British botanists—thus *Barbarea* is superseded by *Campe* of Dulac, with *C. verna* (Michx.) Heller, *C. stricta* L. (Andrzej.) W. F. Wight, and *C. Barbarea* L. (W. F. Wight) as the names of our three species. There is a very full glossary and a single index with 42 plates, mostly of individual plants. No use is made of the page-headings, which throughout give merely the title of the volume—even the glossary is headed "Flora of the District of Columbia"! The Flora contains 646 genera and 1630 species.

The recent Bulletins of the Philippine Department of Forestry contain *Philippine Bamboos* (no. 15), with 33 plates: *Philippine Forest Products as Sources of Paper Pulp* (no. 16); and descriptions of the species of *Philippine Mangrove Swamps* (no. 17) with 47 plates, which include figures of the ant-inhabited *Myrmecodia* and *Hydnophytum* and of *Polypodium sinuatum*, also ant-inhabited. Dr. W. H. Brown and Mr. A. F. Fisher, of the Bureau of Forestry, are jointly responsible for the three Bulletins.

Several papers have been published in recent years by Prof. W. A. Setchell and Dr. N. L. Gardner on the marine algæ of Western America. These results are now being combined by the authors into a complete account of the flora, the first part of which is issued under the title—*The Marine Algæ of the Pacific Coast of North America, Part I.: Myxophyceæ* (University of California Publications, Botany, viii. 1919, pp. 1–138, 8 plates); and the three remaining parts are stated to be in advanced preparation. The Myxophyceæ contain thirty genera, under which are placed ninety-six species and some varieties. These are all clearly and concisely described, and are often illuminated with valuable critical notes. Further, the identification of specimens is facilitated by the keys provided. Judging from the present part, this monograph, long needed, will provide a complete and most valuable account of the algæ of the west coast of North America.—A. G.

The second part of the *Account of the Herbarium of the University of Oxford*, by S. H. Vines, M.A., and G. C. Druce, LL.D., which has lately been issued by the Clarendon Press, contains an Index of contributors to the Herbarium and of other collections existing in Oxford, on which there are interesting notes. They include volumes at Merton College, collected by Robert Huntingdon and Charles Willughby in the seventeenth century; two herbaria bequeathed to Wadham College by Richard Warner (1713?–75); the herbarium of Edward Morgan (fl. 1639–72) and that of Sir George Wheler (1650–1724)—these at the Bodleian.

The *Adventive Flora of Tweedside*, by Ida M. Hayward, F.L.S., and George Claridge Druce, LL.D. (Arbroath, Buncle) is an exhaustive account of the adventitious or alien flora of Tweedside which during recent years has attracted much notice. The work, which is fully descriptive and is prefaced by a useful introduction, contains much interesting matter, but as a copy has not reached us for review we must content ourselves with calling attention to its publication. Dr. Thellung, to whom the book is dedicated, has lately published (Mitth. Bot. Mus. Zürich, lxxxiii.) a third instalment of his "Beiträge zur Adventivflora der Schweiz."

The *Kew Bulletin* (No. 1, 1920; March) contains papers on "The Indian Species of *Mimosa*," by J. S. Gamble, which includes descriptions of three novelties: on the seeds of *Momordica cochinchinensis*; on "*Clematopsis*, a primitive genus of Clematideæ," by Mr. J. Hutchinson, with five new species; "Diagnoses Africanæ," relating to various orders: a note on "the Rev. H. F. Tozer [1829–1916] and plants collected by him in the Nearer East"; and a notice of Sir William MacGregor (1846–1919), whose plants, like those of Tozer, are at Kew.

The vacancy in the Regius Professorship of Botany in Aberdeen University, caused by the death of Prof. Trail, has been filled by the appointment of Mr. W. G. Craib, who has lately been lecturing on forestry in Edinburgh under Prof. Balfour. Mr. Craib was at one time Superintendent of the Calcutta Botanic Gardens, and on his return to England became Assistant for India at Kew.

The *Transactions of the Perthshire Society of Natural Science*, vol. vii. pt. 1. contains a list of the *Discomycetes* of Perthshire by Mr. James Menzies.

"JOURNAL OF BOTANY" REPRINTS.

In view of the fact that the stock of these is in some cases practically exhausted, the attention of our readers is directed to the list which appears on the following page. Old subscribers of course already possess the matter contained in them in the pages of the *Journal*; but some of them appeared several years ago, and recent subscribers will thus not possess them. Some, which do not appear in the list, are already out of print; of others very few copies remain, and it will of course be impossible to reprint them: among the latter may be mentioned Mr. Jameson's *Genera and Species of British Mosses*, Mr. Riddelsdell's *Flora of Glamorganshire*, Mr. Dallman's *Notes on the Flora of Denbighshire* (1911), and Mr. Bennett's *Supplement to 'Topographical Botany.'* Of the Supplements to the *Biographical Index* no complete sets remain. It had been hoped before this to issue the second edition of the work, in which these Supplements are of course incorporated, but the present cost of paper and labour has rendered this impossible. Of the *Index* itself no copies remain, these having been lost in the course of transferring the stock to Messrs. Adlard. Mr. Garry's *Notes on the Drawings of Sowerby's 'English Botany,'* containing, as it does, much topographical information and numerous unpublished notes by Smith, Sowerby and others, should be in the possession of all interested in the history of British Botany: only sixteen copies remain.

It may be pointed out that, although for the most part relating to British Botany, certain of the reprints have a more general appeal. Such are the *Index Abecedarius*—a list of the plants in the first edition of Linnæus's *Species Plantarum*, showing at a glance what are included in that work, which has no index of species; the *History of Aiton's 'Hortus Kewensis,'* which contains much information as to the authors and contents of that classical work; the *Flora of Gibraltar*, which, besides a complete list, contains notes on the more interesting species; Linnæus's *Flora Anglica*—the first English Flora—has a bearing upon nomenclature: of all these there are numerous copies.

[*Over.*

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No. 689 MAY, 1920 Vol. LVIII

THE JOURNAL OF BOTANY

BRITISH AND FOREIGN

EDITED BY

JAMES BRITTEN, K.C.S.G., F.L.S.

LATE SENIOR ASSISTANT, DEPARTMENT OF BOTANY, BRITISH MUSEUM.

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THE JOURNAL OF BOTANY was established in 1863 by Seemann. In 1872 the editorship was assumed by Dr. Henry Trimen, who, assisted during part of the time by Mr. J. G. Baker and Mr. Spencer Moore, carried it on until the end of 1879, when he left England for Ceylon. Since then it has been in the hands of the present Editor.

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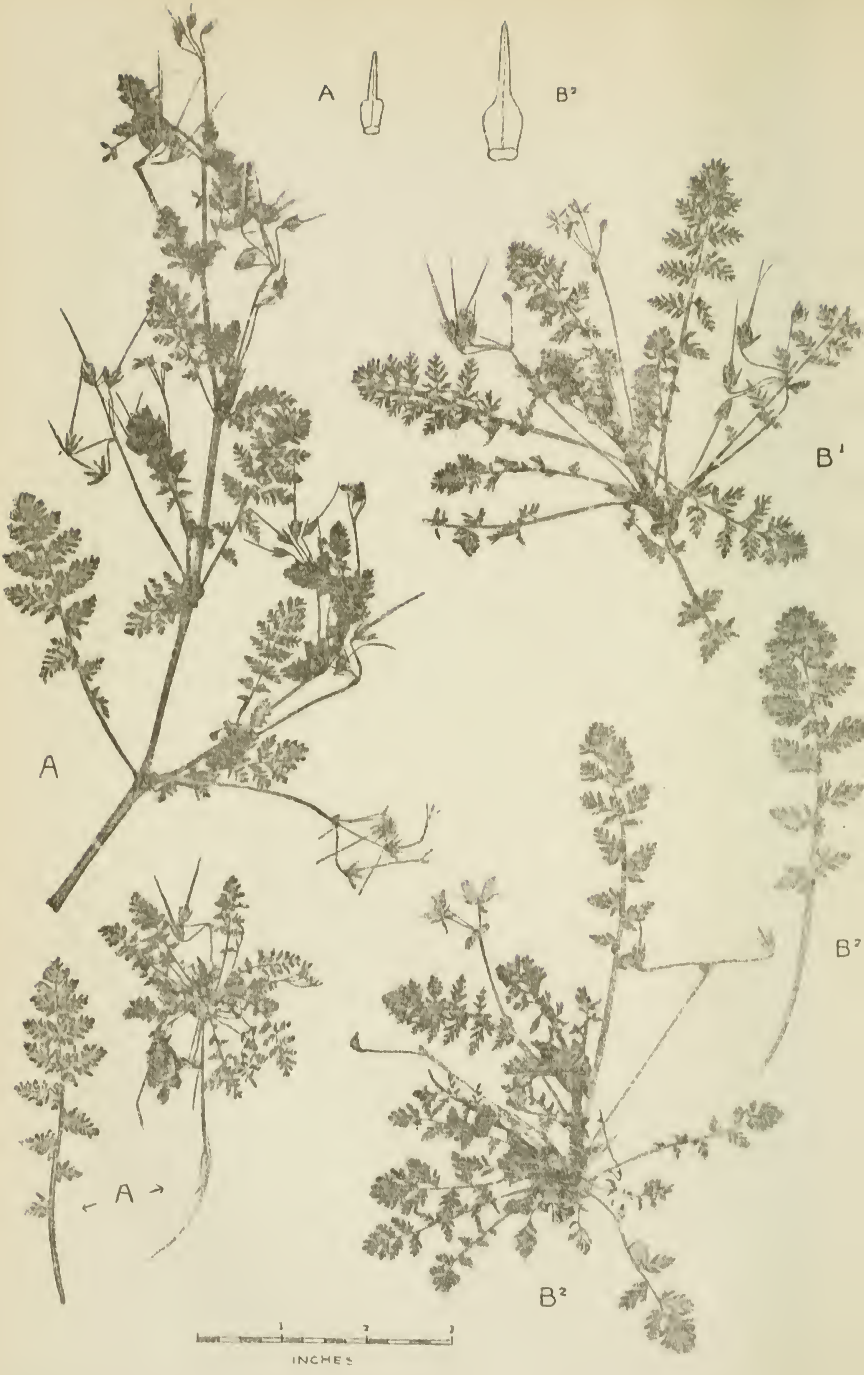
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INCHES

W. F. Taylor, photo.

A. *ERODIUM NEGLECTUM* Baker & Salmon.

SOME SEGREGATES OF ERODIUM CICUTARIUM L'Hérit.

By Edmund G. Baker, F.L.S., and C. E. Salmon, F.L.S.

(Plate 554.)

The segregates of *Erodium cicutarium* growing in Britain have never been very satisfactorily determined. In the present paper it is proposed to deal only with the maritime forms, leaving discussion of the various inland varieties for a future note.

Through the courtesy of Dr. De Wildeman of Brussels, we have been enabled to study the types of Dumortier's species, *E. glutinosum* & *E. dentatum*, described in Bull. Soc. Bot. Belg. iv. 345 (1865), and as we have also had access to many authentically named specimens of Jordan's species, a few notes on a comparison of these with plants growing in Britain may be of interest. "*E. glandulosum* Dum," often mentioned by authors, does not actually exist.

The segregates of *E. cicutarium* may be conveniently divided into two sections:—A. Plants *confined* to sand dunes or other places near the sea. B. *Inland* plants, which, it must be noted, often may be found in sandy places near the coast also.

In 1882, Clavaud in Act. Soc. Linn. Bord. xxxv. p. 425, published a classification of the forms and varieties of *E. cicutarium*, based mainly on the presence or absence of a furrow surrounding the pit of the carpel. The main features of his key are as follows:—

A. *cinctum*. "Segments des feuilles ordinairement non découpés jusqu' à la côte. Fossettes apicilaires du fruit entourées d'un sillon concentrique lisse plus ou moins marqué."
  a. *chærophyllum*.
    a. palllidiflorum (including *parviflorum* Jord. and *Boræanum* Jord.).
    b. rubriflorum (=*triviale* Jord.).
  b. *pimpinellæfolium*.
    a. ochrostigma (=*commixtum* Jord.).
    b. porphyrostigma (=*prætermissum* Jord.).
B. *fossum*. "Segments des feuilles ordinairement découpés jusqu' à la côte ou très près de la côte. Fossettes apicilaires du fruit non entourées d'un sillon concentrique."
  a. *arenarium* (=*pilosum* Bor.).
    a. glutinosum.
    b. vestitum.
    c. subglabrum.
  b. *laxum*.

It should be noted that Clavaud's *arenarium* is stated by him to equal Boreau's *E. pilosum*; the latter is founded upon the *Geranium pilosum* of Thuillier (Fl. Paris, ed. 2, 346, 1799), an inland plant from the Bois de Boulogne and forest of Fontainebleau, described as being very pilose, but no mention is made of glands. Boreau, however, amplifies Thuillier's diagnosis and admits glandular plants under that name, probably including some maritime forms.

In 1905, Brumhard (Monog. Ubers. Gatt. *Erodium*) gave a complete list of the whole genus with a clavis, but we cannot concur with a number of his conclusions, particularly as regards synonymy.

In 1912, Dr. Knuth issued his Monograph of the *Geraniaceæ* (*Pflanzenreich*, 53 Heft, iv. 129, p. 271), where he separates *E. bipinnatum* Willd., *E. cicutarium* L'Hérit., and *E. moschatum* L'Hérit., as follows:—

A. "*Fovea plica concentrica destituta. Pedunculi 2–4 flori.*"—*E. bipinnatum* W. and var. *β. sabulicolum* Jord.
B. "*Fovea plica concentrica manifeste circumscripta. Pedunculi sæpissime 5–7 flori.*"—*E. cicutarium* L'Hérit. and *E. moschatum* L'Hérit.

He thus considers *E. sabulicolum* Jordan (with which we have satisfied ourselves that *E. glutinosum* Dum. is synonymous) to be better placed as a variety of *E. bipinnatum* Willd. than under *E. cicutarium* L'Hérit. This point will be dealt with later.

Our study of the British forms confined to the coast leads us to adopt the following classification, omitting for the present, plants which, occurring normally inland, may frequently be found on sandy ground in proximity to the sea. We have included *E. dentatum* in the clavis as it is a species very likely to occur on our coasts.

Pit of carpel not surrounded by a furrow. Fertile stamens with filaments sub-dentate or suddenly enlarged at the base.
    Peduncles few (2–3) flowered, ± shorter than the leaves.
        1. Very glutinous. Beak of carpel 15–20 mm. long. *E. glutinosum.*
        2. Slightly glandular or glutinous. Beak of carpel 25–29 mm. long.................... *E. dentatum.*
    Peduncles many (3–5) flowered, ± longer than the leaves.
        3. .... *E. neglectum.*
Pit of carpel surrounded by a furrow. Fertile stamens with filaments gradually enlarged at the base.
        4. Glandular. Peduncles many-flowered. Leaflets broad.............................. *E. Lebelii.*
        5. Eglandular. Peduncles few-flowered. Leaflets narrow .... *E. Ballii.*
Pit of carpel not surrounded by a furrow. Fertile filament subdentate or suddenly enlarged at base.
    Peduncles 2–3 flowered, short.

1. E. GLUTINOSUM Dumortier in Bull. Soc. Bot. Belg. iv. 345 (1865).

E. sabulicolum Jordan ined. ex Billot, Fl. gall. et germ. exsicc. 1845 (1855) *nomen.*

E. bipinnatum Willd. *β. sabulicolum* Brumh. Mon. Erod. 55 (1905); Knuth, in *Pflanzenreich*, 53 Heft, iv. 129, p. 273 (1912).

Most modern authors (Ascherson & Graebner, Brumhard, Rouy & Foucaud, Knuth, etc.) place this plant as a variety of *E. bipinnatum* Willd., which, as already pointed out, differs specifically from *E. cicutarium* agg., but we, however, should hesitate to so group it for the following reasons:—

E. bipinnatum was founded upon the *Geranium bipinnatum* of

Cavanilles (Diss. bot. v. 273, t. 126, f. 3, 1788) from Northern Africa, and in view of its glabrous stem, remarkably finely-cut leaves with narrow linear segments, beak of about 40 mm., fertile filaments with pronounced erect acute teeth as in *E. moschatum*, and geographical range, we doubt the advisability of considering *E. glutinosum* a variety of this species.

E. cicutarium L'Hérit. β. *glandulosum* Van den Bosch (Prod. Fl. Batav. 55, 1850), to which, of late years, many British plants have been referred, is probably, from the description, synonymous with Dumortier's *glutinosum*, but we have not been able to examine authentic material. *E. sabulicola* Lange (Willkomm & Lange, Prodr. Fl. Hisp. iii. 537, 1878) seems evidently a form of *E. glandulosum* Dum., but Lange's own plant has not been seen.

Plant small, ± compact with no long straggling branches, provided with an abundance of glandular hairs to which sand adheres. *Stems* patent-erect, not prostrate. *Leaves* small, ± bipinnatifid, finely cut, segments short, ovate, subacute. *Peduncles* 2–3-flowered, shorter than or slightly exceeding leaves. *Flowers* small, about 6 mm. in diameter, fleshy-white; petals subequal, unspotted; sepals ± 3–5 mm. long. *Fertile stamens* with filament suddenly enlarged near the base or sub-dentate with a "shoulder." *Anthers* pale yellow; pollen orange. *Stigma* cream-coloured or at any rate not dark as in *E. dentatum*. *Carpels* 4–5 mm. long, very attenuate-stipitate at base; pit small, destitute of outer furrow; twists of awn 3–5; beak 15–20 mm. long.

At once distinguished from other forms of *E. cicutarium* by its small flowers, short and few-flowered peduncles, and short beak, and, on closer examination, by the carpel-pit lacking the outer furrow.

Exsiccata. Billot, Fl. gall. et germ. 1845! (as *E. sabulicolum* Jord. ined.).

Distribution. BRITAIN. *Cheshire*, v.c. 58; New Brighton! 1868. No. A. John Barrow (as *E. cicutarium*) (Hb. Manchester). Rather less glutinous than type. *Lancashire south*, v.c. 59. Seaforth Common! 1860 & 1866—not the 1870 plant, which is another species —H. S. Fisher (as *E. cicutarium* var. *pilosum*) (Hb. Manchester). Less glutinous than type. *Isle of Man*, v.c. 71. Point of Ayre! 1917. H. J. & J. A. Wheldon (as *E. bipinnatum* Willd. var. *sabulicolum* Lange) (Hb. Mus. Brit.).—BELGIUM. Dunes of Flanders! Dumort.—FRANCE. *Finistère.* Penmarck! 1900. A. Pellat (as *E. cicutarium* var. = *E. sabulicola* Lange) (Hb. Manchester). *Vendée.* Dunes de la Tranche! 1855. P. N. Ayraud. Billot, 1845 (as *E. sabulicolum* Jord. ined.) (Hb. Mus. Brit.). *Charente-Infér.* Fourras! 1884. R. P. Murray (as *E. cicutarium*) (Hb. Mus. Brit.).—SPAIN. Pontevedra and Vigo (*Lange*).

2. E. DENTATUM Dumortier, *l. c.*

This was placed by the author in a special section with *E. moschatum*, distinguished by having the fertile stamens bi-dentate at the base. Upon dissecting Dumortier's type, however, we were surprised to find that the filaments were merely suddenly enlarged or with a right-angled "shoulder"—exactly as in *glutinosum*—and were quite unlike those of *E. moschatum* (see above).

Plant small, compact, with no long straggling branches, with many hairs, ± glandular, but no adhering sand. *Stems* short, prostrate. *Leaves* small, ± bipinnatifid, finely cut, segments short, acute. *Peduncles* 2-flowered, shorter than or slightly exceeding leaves. *Flowers* small, about 7 mm. in diameter, rose-coloured; petals unequal, unspotted, decidedly longer than sepals; sepals ± 7 mm. long. *Fertile stamens* as in *E. glutinosum*. Pollen yellow. *Stigma* purple. *Carpels* 5–5·5 mm. long, very attenuate-stipitate at base; pit small, destitute of outer furrow; twists of awn 5–7; beak 25–29 mm. long.

Compared with *E. glutinosum*, it will be seen that *E. dentatum* differs, *inter alia*, by its larger flowers with unequal petals and its prostrate stems; it is distinguished from *E. cicutarium* agg. by its fewer-flowered and shorter peduncles, carpel-pit wanting outer furrow.

Distribution. BELGIUM. Dunes of Flanders! Dumortier.—HOLLAND. Dunes of Zeeland, Dumortier.

Although this species is as yet unknown in Britain, a description seems desirable, as it probably occurs upon our eastern or south-eastern shores which front its Continental habitats.

Peduncles 3–5-flowered, longer.

3. **E. neglectum** nob.

Plant either small and compact or more robust with elongated branches, copiously glandular with adhering sand-grains. *Stems* prostrate-ascending, elongated. *Leaves* medium-sized, rather deeply pinnatifid, segments ± obtuse. *Peduncles* 3–5-flowered, exceeding the leaves. *Flowers* large, about 12 mm. in diameter, pale lilac; petals slightly but distinctly unequal, unspotted, exceeding the sepals; sepals ± 3·5 mm. long. *Fertile stamens* as in *E. glutinosum*. *Anthers* claret-coloured; pollen orange. *Stigma* pale claret. *Carpels* c. 5 mm. long, considerably attenuate-stipitate at the base; pit small, destitute of outer furrow; twists of awn 4–5; beak glabrous, 20–22 mm. long.

We have been reluctantly compelled to add a new name to the many already in existence as we can find no description to fit this plant, which may be concisely diagnosed as follows:—

Planta *dense glandulosa*, ad *E. glutinosum* Dum. valde accedens sed major, compacta vel ramis elongatis prostrato-adcendentibus. Folia *valde pinnatifida*, segmentis ultimis ± obtusis. Pedunculi 3–5-*flori*, folia excedentes. Flores circa 12 mm. in diametro, pallide lilacini; petala leviter inæqualia, *immaculata*. *Filamenta fertilia subdentata*; antheræ vinaceo-purpureæ; pollen aurantiacum. Stigma pallide vinaceo-purpureum. Carpella sub apice cavo parvo instructa sed *sulco exteriore destituta*; rostrum 20–22 mm. longum.

From many forms of *E cicutarium* this may be distinguished by its deeply pinnatifid leaves, sub-dentate filaments, orange pollen, and the carpel-pit lacking an outer furrow.

Exsiccata. *E. S. Marshall*. No. 1048 (Kent)! No. 1656 (Wexford)! No. 2545 (Glamorgan)! (All Hb. Mus. Brit., labelled *E. cicutarium* var. *glandulosum* Bosch.).

Distribution. BRITAIN. *Isle of Wight*, v. c. 10. Bembridge! Miss R. M. Cardew. (Hb. Mus. Brit.). *Kent east*, v. c. 15. Deal! 1907. F. L. Foord-Kelcey (Hb. Manchester). Sandhills near

Sandwich! 1888; coast E. of Littlestone! 1893. E. S. Marshall. No. 1048 (Hb. Mus. Brit.)! *Glamorgan*, v.c. 41. Pendine! 1856. Hb. Bentham; Three cliffs Bay near Swansea! 1858. Hb. Bentham (Hb. Kew.). Sker Sands near Porthcawl! 1901. E. S. Marshall. No. 2545 (Hb. Mus. Brit.). *Pembrokeshire*, v.c. 45. Holloways & Penally Burrows, Tenby! 1873. C. Bailey (Hb. Mus. Brit. & Manchester). *Carnarvonshire*, v.c. 49. Llandudno! 1867. John Barrow (Hb. Manchester). *Anglesey*, v.c. 52. Sandy ground S. of Llyn Maelog! 1916. C. E. S. *Cheshire*, v.c. 58. Wallasey Sand dunes! 1892. J. A. Wheldon. *Lancashire south*, v.c. 59. Southport! 1894. C. Bailey (Hb. Manchester). Sand dunes, Hightown! 1918. J. A. Wheldon. *Lancashire, West*, v.c. 60. Sandhills, St. Annes-on-the-Sea! 1901 & 1904. C. Bailey (Hb. Manchester). *Id. loc.*! 1912. J. A. Wheldon. *Clyde Isles*, v.c. 100. Bute! 1827. Greville (Hb. Kew.).—IRELAND. Wexford (v.c. 12). Plentiful on the sandhills, Rosslare! 1896. E. S. Marshall. No. 1656 (Hb. Mus. Brit.).

Through the kindness of M. Beille of Bordeaux we have seen examples of many of Clavaud's plants. As regards his *E. cicutarium* a. *arenarium* α. *glutinosum*, a specimen so labelled collected on the dunes of Soulac (Gironde) by M. Brochon in 1886 seems closely allied to our *E. neglectum*, and the example is most probably the early acaulescent state of that plant.

It must be noted, however, that Clavaud (*l. c.*) states that *arenarium* (under which *glutinosum* is grouped) has spotted petals which we have not, so far, noted in flowers of *neglectum*. However, it is evident that the spotting or non-spotting of petals in *E. cicutarium* forms is not a *truly constant* character, although fairly reliable in most cases.

Pit of carpel surrounded by a furrow. Fertile stamens with filaments gradually enlarged at base.

4. E. LEBELII Jordan, Pugillus, pl. nov. 48 (1852).

The *E. cicutarium* L'Hérit. var. *appressum* De Wild. & Dur. (Prod. Fl. Belg. iii. p. 377, 1899) is very likely, by the description, the early compact state of *E. Lebelii*, but we have not seen the authors' types.

Plant rather robust, at first compact, then slightly diffuse with elongated branches, copiously hairy, with many sessile glands, especially on sepals. *Stems* prostrate-ascending, not very elongated. *Leaves* medium or large, rather shallowly pinnatifid, leaflets broadly ovate, segments ± acute, blueish- or yellowish-green. *Peduncles* 3–6-flowered, exceeding the leaves. *Flowers* large, very pale pinky-white, about 16 mm. in diameter; petals broad, unequal, unspotted, considerably exceeding sepals; sepals c. 4·5 mm. long. *Fertile stamens* with filaments gradually enlarged at the base. *Anthers* pinky-yellow; pollen reddish-orange. *Stigma* pale pinky-yellow. *Carpels* c. 6 mm. long, considerably attenuate-stipitate at the base; pit conspicuous with a shallow outer furrow; twists of awn 5–6; beak glabrous, 22–24 mm. long.

This beautiful plant may usually easily be recognized by its very pale pink or whitish flowers with broad petals, reddish-orange pollen, and usually ± compact habit of growth; the leaves, too, rather remind one of *E. moschatum*.

Exsiccata. A. H. Wolley-Dod, No. 1845 (Devon)! (as *E. cicutarium* var. *glandulosum* Bosch.).

Distribution. BRITAIN. *Devon south*, v. c. 3. Sandy turf by shore, Broad Sands! 1909, No. 1845; Berry Head! 1909. A. H. Wolley-Dod. *Pembrokeshire*, v.c. 45. Penally Burrows, Tenby! 1873. C. Bailey (Hb. Manchester) (sheet also contains *E. neglectum*; a mixture). *Anglesey*, v.c. 52. Near Llyn Maelog! 1916. C. E. S. *Lancashire south*, v.c. 59. Birkdale sand-hills, Southport! 1877. C. Bailey (Hb. Manchester).—FRANCE. "In maritimis Neustriæ: Lebel" (*Jordan*). *Manche*; Granville! 1864. A. Jordan (Hb. Mus. Brit.).

5. E. BALLII Jordan, Pugillus pl. nov. 44 (1852).

Plant apparently rather compact, eglandular. *Leaves* rather finely cut, reminding one of *E. triviale*, ultimate segments obtuse. *Peduncles* about 3-flowered, apparently exceeding the leaves. *Sepals* of flowers c. 5 mm. long. *Carpels* 6 mm. long; pit with faint very narrow outer furrow; twists of awn 5–6; beak 20–24 mm. long.

This rather meagre description is based upon Jordan's short diagnosis and upon examination of a plant in Herb. Kew labelled "*E. Ballii* Jord. Sables marit. à Grenneville, Manche, 1864. Coll. Lebel"; unfortunately the specimen is a poor one.

Although we have, so far, seen no British examples that could come under this name, the interest lies in the fact that Jordan described the plant (*Pugillus*, p. 44) from specimens gathered by John Ball on the sea-coast of Ireland. After describing *E. triviale* he continues:—"Aliam speciem *E. Ballii* Jordan his duobus precedentibus affinem sed sine dubio diversam, ex Hiberniæ maritimis à cl. Ball acceptam, in horto pariter ex seminibus eduxi. Habitu proprio dignoscitur et præterea fructus rostro tantum 10 lin. (20–24 mill.) longo, carpelli sulco concentrico perangusto et aristarum gyris 5–6. Caracteres autem omnes in vivo nondum annotavi. Eumdem, ni fallor, plantam cl. Lebel mihi ex Neustriæ maritimis nuperrime misit." We trust that Irish botanists will search for this plant and supply a fuller description.

The following plants, which seem to be allied to *E. glutinosum* on account of their small much-dissected leaves, short and few-flowered peduncles, and small flowers, deserve further study on the spot; all the examples we have seen (Hb. Mus. Brit.) appear to be *practically sterile* with barely a single head of fruit:—(1) *Lancashire north*, v.c. 69^B^. Isle of Walney. E. Hodgson. (2) *Cumberland*, v.c. 70. Coulderton Shore. J. Adair. 1900. (3) *Jersey*. Gorey Common. F. Naylor. 1862.

It would be very helpful if botanists, before drying their specimens, would note the following points:—Stems whether prostrate or ascending; size and colour of flower, and whether petals equal or unequal, spotted or not; colours of anthers, pollen, and stigma; whether filament is subdentate or gradually enlarged

Our thanks are due to the Manchester University Herbarium authorities, to Dr. De Wildeman, to M. Beille, and to Mr. J. A.

Wheldon for the loan of specimens: we have also had the opportunity of examining the Erodiums in the herbarium of the late E. S. Marshall.

EXPLANATION OF PLATE 554.

A. *E. neglectum* nob. from Anglesey, with filament enlarged 12 times.
B. *E. Lebelii* Jord. (1) From Anglesey. (2) From Broad Sands, Devon, with filament enlarged 12 times.

MYCETOZOA FROM CORNWALL.

BY G. LISTER, F.L.S.

THE accompanying list of Mycetozoa found in Cornwall is due very largely to the observations of the late Dr. Alfred Adams. As long ago as 1906, specimens were sent by him from Looe and the surrounding country to my father and me for identification; and since 1911, when I first had the pleasure of meeting him at a foray of the British Mycological Society at Taunton, until his death in October 1919, few months have passed without my receiving packages of interesting specimens which he wished to discuss with me. Not only was he a good collector, but he was also a keen and accurate student of living Mycetozoa. He carried on many successful cultivations of plasmodia found in the open, and one year kept *Badhamia nitens* in the active stage for nine months, feeding it on the leathery fungus *Stereum hirsutum.* He was the first to record the three arboreal species *Badhamia versicolor*, *B. affinis*, and *Diderma arboreum* for England.

B. versicolor was first discovered by the Rev. William Cran in Aberdeenshire, on the bark of exposed trees; it has since been recorded from East Canada and Colorado; *B. affinis* and *Diderma arboreum* were found in Britain for the first time by Mr. Cran; the former has been recorded, besides the type from Chili, from Pennsylvania, from Japan, and South Africa. The type of *Diderma arboreum* was found in Ceylon; it has also been recorded from the Malay Peninsula by Mr. A. R. Sanderson, and from Japan by M K. Minakata.

Dr. Adams was the first to find *Physarum nucleatum* in Britain, when in July 1911 he obtained a considerable development on decayed wood. Up to that time this species, which is not uncommon in the tropics, in the United States and Japan, had been recorded in Europe only once, from a greenhouse in Zürich. It has since been obtained in North Devon by Mr. N. G. Hadden, and in Roumania by Dr. Marcel Brandza. The sporangia from England and Roumania differ from the elegant tropical specimens in being shortly stalked or even, occasionally, sessile, and the characteristic ball of calcareous matter in the centre of the capillitium is not conspicuously developed, but in other respects they are typical.

There are two other collectors to whom we are especially indebted for notes on Mycetozoa from Cornwall. Mr. G. H. Fox, of Glendurgan, Falmouth, obtained, besides more abundant species, fine specimens of *Physarum citrinum* and *Stemonitis splendens* var.

Webberi. Mr. J. M. Coon, of St. Austell, has made a small collection of Cornish Mycetozoa, which includes two rare species, *Oligonema nitens* and *Cornuvia Serpula*, both found in large developments on spent tan in a tan-yard at Grampound: this is the only record of *Cornuvia Serpula* in Britain.

It was Dr. Adams's intention to publish a paper on Mycetozoa found in Cornwall, and he has left ample notes on the subject. In the following list the specimens were collected by him, unless otherwise specified. The initials G. H. F. and J. M. C. refer to Mr. Fox's and Mr. Coon's collections respectively.

A full list of the localities where Dr. Adams's gatherings were found has been kindly furnished me by his son, Mr. J. H. Adams, from his father's notes.

Ceratiomyxa fruticulosa (Müll.) Macbr. Common.

Badhamia capsulifera (Bull.) Berk. Kilminorth Wood; St. Martin's and Carhayes Castle, St. Austell (J. M. C.).

B. utricularis (Bull.) Berk. Kilminorth Wood; Morval; St. Martin's, &c.

B. nitens Berk. Morval.

B. versicolor Lister. Lanreath, on trunk of a living elm.

B. macrocarpa (Ces.) Rost. Polwellan grounds, Looe.

B. affinis Rost. Trelawne, on moss on a living beech-trunk.

B. panicea (Fr.) Rost. Lanreath; St. Martin's.

Physarum citrinum Schum. Near Falmouth on mossy wood (G. H. E.).

P. mutabile (Rost.) Lister. Lanreath; Lansallos, amongst short turf on a lawn.

P. psittacinum Ditm. Found several times, Kilminorth Wood.

P. viride (Bull.) Pers. Kilminorth Wood.

P. nucleatum Rex. Kilminorth Wood.

P. pusillum (Berk. & Curt.) Lister. Klymiarven garden, Looe; Trelawne.

P. nutans Pers. Abundant.

P. nutans var. *leucophæum* Lister. Abundant.

P. nutans var. *robustum* Lister. Looe.

P. compressum Alb. & Schw. Pendriffey, Pelynt; Klymiarven.

P. cinereum (Batsch) Pers. Trenean; Sandplace.

P. vernum Somm. Trenean.

P. bitectum Lister. Trenean; Lanreath; Looe.

P. conglomeratum Rost. Trenean; twice.

P. virescens Ditm. Kilminorth Wood.

Fuligo septica Gmel. Kilminorth Wood.

F. muscorum Alb. & Schw. Kilminorth Wood; found in plasmodium.

Cienkowskia reticulata (Alb. & Schw.) Rost. Portnadlar, found in orange plasmodium, which developed in a fortnight; Venton Vanes. Only recorded before in Britain by the Rev. M. J. Berkeley in Leicestershire, 1875.

Craterium minutum (Leers) Fries. Frequent.

C. leucocephalum Ditm. Looe; Pelynt.

C. aureum (Schum.) Rost. Kilminorth Wood; found several times.

Leocarpus fragilis (Dicks.) Rost. Kilminorth Wood. St. Austell (J. M. C.).

Diderma hemisphericum (Bull.) Hornem. Frequent.

D. effusum (Schw.) Morg. Lanreath; Polperro; Trenean.

D. testaceum Pers. Lanreath.

D. radiatum (L.) Lister var. *umbilicatum* (Fr.) Meyl. Kilminorth Wood.

D. arboreum G. Lister & Petch. Trelawne, on beech trunks.

Diachæa leucopoda (Bull.) Rost. Not unfrequent.

Didymium difforme (Pers.) Duby. Frequent.

D. difforme var. *comatam* Lister. Not unfrequent.

D. complanatum Rost. Kilminorth Wood; twice.

D. Clavus (Alb. & Schw.) Rabenh. Kilminorth Wood; Trelawne.

D. melanospermum (Pers.) Macbr. Muchlavnick. St. Austell (J. M. C.).

D. nigripes Fries. Frequent.

D. nigripes var. *xanthopus* Lister. Looe.

D. squamulosum (Alb. & Schw.) Fries. Frequent.

Mucilago spongiosa (Leyss.) Morg. Frequent.

Stemonitis fusca Roth. Frequent.

S. splendens Rost. Glyn Valley, the typical form, merging into var. *Webberi*.

S. splendens var. *Webberi* Lister. Glendurgan (G. H. F.).

S. ferruginea Ehrenb. Kilminorth Wood.

S. flavogenita Jahn. Not uncommon.

Comatricha nigra (Pers.) Schroet. Frequent.

C. nigra var. *alta* Lister. Looe.

C. laxa Rost. Shortcross; Redgate, Liskeard.

C. pulchella (Bab.) Rost. Kilminorth Wood; St. Martin's.

C. tenerrima (Curtis) G. Lister. Portnadlar.

Enerthenema papillatum (Pers.) Rost. Kilminorth Wood; Trenean.

Lamproderma arcyrionema Rost. Kilminorth Wood; Herodsfoot.

L. scintillans (Berk. & Br.) Morg. Frequent.

L. columbinum (Pers.) Rost. Kilminorth Wood; St. Martin's.

L. violaceum (Fries) Rost. Looe, on leaves.

Brefeldia maxima (Fries) Rost. Lanreath. Falmouth (G. H. F.).

Cribraria argillacea Pers. Trenean, &c.

C. vulgaris Schrad. Several times found.

Dictydium cancellatum (Batsch) Macbr. Not rare.

Reticularia Lycoperdon Bull. Frequent.

Lycogala epidendrum (L.) Fries. Frequent.

Trichia favogenita Pers. Near Bodmin.

T. affinis de Bary. Frequent.

T. persimilis Karst. Frequent.

T. scabra Rost. Once found.

T. varia Pers. Frequent.

T. contorta (Ditm.) Rost. Tregarrick Mill; Trenean; Morval.
T. decipiens (Pers.) Macbr. Frequent.
T. Botrytis Pers. Frequent.
Oligonema nitens (Lib.) Rost. Grampound (J. M. C.).
Hemitrichia abietina (Wigand) Lister. Bodmin Valley; a single ovoid short-stalked sporangiums on moss; a puzzling specimen.
Cornuvia Serpula (Wig.) Rost. Grampound (J. M. C.).
Arcyria ferruginea Saut. Morval; Penearthtown.
A. cinerea (Bull.) Pers. Frequent.
A. pomiformis (Leers.) Rost. Hall Wood, Pelynt.
A. denudata (L.) Wettst. Frequent.
A. incarnata Pers. Frequent.
A. nutans (Bull.) Grev. West Looe.
Perichæna depressa Libert. St. Martin's; Morval; Tregarrick Mill.
P. corticalis (Batsch) Rost. Not uncommon.
P. vermicularis (Schw.) Rost. ? Near Looe.
Dianema depressum Lister. Kilminorth Wood.
Prototrichia metallica (Berk.) Mass. ? Near Looe.

The above list contains eighty-two species and four varieties.

PLANT DERMATITIS.—I.

By E. Philip Smith
(Botanical Department, Oxford).

Plant Dermatitis (*Dermatitis venenata* of medical writers), that is, diseases of the skin caused by plant-products, is probably much more frequent in occurrence than is usually supposed, owing to the fact that the eruptions produced so closely simulate one of the many forms of eczema, erysipelas, etc., that they are commonly diagnosed and treated as such. A more stringent inquiry into the history of the case frequently results in the discovery of evidence of contact with some poisonous plant which has wrought the damage. It is therefore desirable to have some knowledge of the plants which are known to have disastrous effects upon the skin of those who come in contact with them, in order that they may be avoided; and that in the event of accidental affection, a correct diagnosis may be made.

Plants causing irritation to the skin may be, roughly speaking, divided into two main groups: those in which the active principle is contained in the cell-sap or in latex, and those in which it is secreted by glands or hairs of various kinds, whether over the whole surface of the plant, or localized in some special region. *Irritant cell-sap* covers a very wide range of phenomena, including those due to poisonous alkaloids, phenols, etc., or to the mechanical action of raphides, which work their way in under the skin and so cause an extreme irritation, which is only increased by friction.

A few typical instances may be taken as examples:—

I. Perhaps the commonest case of all, and one which is known to everyone in this country, is the case of the Stinging Nettle. The plant, particularly the leaves, is provided with stinging hairs, each consisting of a long stiff shaft, narrowing towards the point, and provided with a small bulbous tip. The portion of the shaft immediately under this tip is not thickened and silicified like the rest, so that a very slight touch is sufficient to break off the bulbous end. The tip breaks off at a slant, leaving a finely pointed hollow shaft, like the needle of a hypodermic syringe, which makes a puncture in the skin through which the secretion can enter. The secretion, which contains albuminoid substances, is injected through this into the skin, and is apparently accompanied by formic acid, which was formerly thought to be the toxic principle; this, however, is quite inadequate to account for the severe symptoms that are sometimes observed (*e. g.* the effect of the sting of tropical nettles, such as *Urtica stimulans* and *Urtica urentissima*, has been known to cause severe continuous pain, tetanus-like symptoms, and even death). A burning, pricking sensation follows the sting, and very soon each spot touched is marked by a raised whitish wheal, surrounded by a zone of reddened skin. In most cases in this country, this is the worst that happens, but occasionally persons with very delicate skins, who are stung over considerable areas, or where the face and eyes are affected, may be rendered quite severely ill. In the Tropics, however, much more striking effects are recorded. The most virulent of the stinging nettles of India is *Laportea crenulata*. It has minute stinging hairs which cause acute pain when touched, and the pain is increased on bathing the affected part in water. *Girardinia heterophylla* causes at most stinging pains, and the young tops are eaten as a vegetable, as the Common Nettle is used in this country. On the other hand, *Girardinia zeylanica* yields a fibre which has been used for making clothes, with unpleasant results, owing to the extreme difficulty experienced in entirely removing the stinging principles, even in the severe processes to which the plant is subjected in order to extract the fibre.

Since the Stinging Nettle is never cultivated as a plant for domestic decoration, injury from it is always accidental, and the results are so immediately apparent as to leave no doubt of their origin. The effects, too, are usually transitory, the wheals commonly subsiding in a few minutes. In most cases no application is necessary, the cure being rapid and spontaneous. If the irritation is severe and seems likely to be prolonged, the use of strong spirit is soothing, partly because it coagulates any proteid present, and by its rapid evaporation has a cooling and analgesic effect. The "Glyco-thymoline" of Messrs. Kress & Owen is also very useful, if applied full strength on gauze or cotton-wool.

II. The cases of *Primula* poisoning, however, are sometimes very mystifying. Primula-dermatitis attracted a great deal of attention about ten or fifteen years ago, although of course plenty of earlier references to it are to be found. There is a certain monotony about the clinical histories. In nearly every case the patient is afflicted with an erythematous eruption accompanied by more or less swelling, generally beginning on the hands, and spreading to the arms, face, and even other parts of the body. The itching and fever may be intolerable, completely preventing sleep, and rapidly wearing out the patient by loss of rest and lack of appetite. There may be only a single attack, or they may be recurrent at short intervals over several months of the year, and finally settle down into a chronic condition which is extremely distressing. The great regularity with which such cases respond favourably to change of scene, but as regularly relapse on returning home (to the source of irritation), might lead to a suspicion of their environmental origin, but frequently much time and trouble are wasted owing to ignorance on the part of both patient and physician. Of course, as soon as the offending plant is discovered and destroyed, recovery is rapid and complete, unless the case has become chronic. The irritant in this case is an oil, which is secreted by glandular hairs all over the leaves and stalk. External conditions are known to have a marked effect upon the development of the oil, so that a person who has hitherto been immune, may, on coming into contact with plants in another locality, be badly poisoned [Weydahl, 1908]. The hairs are normal glandular trichomes, and usually consist of three cells: two more or less elongated as a stalk, and one smaller, rounded head-cell with dense contents. The oily substance is secreted in the usual way beneath the cuticle of the head-cell, so that the former is gradually distended until it bursts, and the secretion is poured out and trickles down the hair. (For stages in the development of the secretion in *Primula obconica*, *P. sinensis*, and *P. mollis*, *cf.* Nestler, 1904 and 1908). The hairs are very delicate and easily broken, consequently the skin is readily affected by the oily substance, and in the case of susceptible individuals the usual unpleasant symptoms follow. It is extremely easy to transfer the irritant to other parts of the body, and every place touched will be affected in a greater or less degree, according to the thickness of the cuticle at the spot.

III. A similar but even more serious type is the poisoning produced by species of *Rhus*, such as *Rhus Toxicodendron* ("Poison Ivy"), *R. venenata* ("Poison Elder"), and other forms such as *R. Cotinus*, *R. Coriaria*, *R. vernicifera*. (The last is the plant from which Japanese lacquer is obtained, and will be dealt with later.) *Rhus Toxicodendron* was put on the market in recent years as an ornamental plant under the trade-name of "*Ampelopsis Hoggii*," owing to a general resemblance to the North American *Ampelopsis quinquefolia*, Virginian Creeper, of commerce, from which it can be distinguished at once by having three instead of five leaflets in its compound leaf. Masquerading under this name, the plant was employed as a decorative climber by many unfortunate people, some of whom suffered severely for their ignorance. A case is known where the plant grew up and surrounded a bedroom window: the owner of the house and his wife, who occupied the room, were both poisoned on the face while handling the foliage when opening or shutting the window, with very serious results.

The active principle of *Rhus Toxicodendron* and *R. venenata* was investigated by Pfaff. An older view ascribed the toxic qualities to an acid which was extracted from the plant, just as the stings of nettles were supposed to be due to formic acid. Pfaff prepared this acid in a pure condition and found it to be merely acetic acid. By distilling the crushed leaves and stem in a current of steam, there was obtained, in addition to this acid, small quantities of an oily substance, which proved to be an active irritant. This oil was obtained in larger quantities by extracting with alcohol and then distilling off the spirit, leaving a black oily residue which was washed with water and taken up in ether. The etherial solution on washing with water and then dilute solution of sodium carbonate, yielded an impure sample of the oil, which was contaminated by resinous oxidation products. The oil was prepared pure by treating with 10–15 times its bulk of 95 °/₀ alcohol. After standing, fractional precipitation with lead acetate gave a precipitate from which the free active oil could be obtained by treating with ammonium sulphide. The free oil, which Pfaff named "Toxicodendrol," was not analyzed, though the pure lead salt gave a provisional formula of $C_{21}H_{30}O_4Pb$. This oil occurs in all parts of the plant: stems, leaves, fruit, and even on the pollen. It is non-volatile, and the least trace of it is irritant: *e. g.* in one case ·005 mg. in two drops of olive oil caused severe pain and swelling. Experiments with the purified free oil produced results exactly similar to a severe case of *Rhus*-dermatitis. That is to say, the attack was characterized by swelling, localized redness, and the formation of papules which developed in the course of a few days into vesicles (which became confluent in many cases), with considerable exudation of serous fluid and the formation of crusts. The attack lasted about 15 days, and at its height the pain and fever were considerable. The poison being a very sticky, non-volatile oil, apparently excreted by the epidermal cells of *actively photosynthetic* leaves during the warm season (the plant is considerably more virulent in America than in this country, and the leaves are not poisonous in autumn, *i. e.* when photosynthesis is not active owing to cold, etc.), which is slowly oxidized in contact with air to a resin, the usual methods of treatment by bland ointments such as carbolized vaseline, by lotions, etc., are only too well calculated to spread the trouble instead of checking it. These substances, such as mutton fat or petroleum jelly, become almost liquid at body temperature, and so dissolve the oil and carry it to other parts of the body. This was clearly demonstrated in the case described above; the fingers of the unaffected hand, which came in contact with the other while dressing it, became poisoned, and so did the arm wherever the dressing had reached. On the other hand, immediate relief was experienced when the injured arm was scrubbed with soap and water, and the swelling, etc. rapidly subsided under this treatment. Dr. Pfaff found that in all cases the best treatment was vigorous mechanical removal of the poisonous oil by scrubbing with soap and water, with or without a preliminary treatment with alcohol. This method answered at any stage of the attack. One point about this dermatitis which makes it rather difficult to diagnose is the fact that there is a "latent period" after contact with the plant before the attack begins. This time varies from 18–24 hours, to as long as 7–9 days, the average time being four or five days, by which time most people would have forgotten an accidental contact with the plant. This "latent time" probably indicates the time taken for the oil to infiltrate the skin, and so is a function of the thickness of the individual cuticle. This *Rhus*-dermatitis has been dwelt upon rather at length, owing to the severity of its nature and the danger of a wrong diagnosis.

IV. Of quite a different type is the so-called "*Lily Disease*," which attacks particularly the flower-pickers in the Scilly Isles, where Daffodils and other Narcissi are grown in enormous quantities for market. It attacks the pickers chiefly during the harvesting season when they are continually exposed to the sap from the cut leaves and stems, although every part of the plant, including the bulb, is said to be violently emetic and irritant (Sowerby & Johnson). It would be impossible to give an exhaustive list of the many varieties of Daffodil and Narcissus grown for market, and it would probably be unnecessary, since it is unlikely that there would be much difference between them from this point of view. The following, however, are definitely singled out for mention by Walsh in his article on "Lily Dermatitis," namely:—*Narcissus odorus*, var. 'Campanelle: *N. poeticus* var. *ornatus*: *N. Tazetta*, in the commercial varieties 'Grand Monarque,' 'Scilly White,' and 'Gloriosus.' These are placed in order of virulence according to the accounts of the workers, but all the varieties are said to be dangerous at times. The flowers are grown in the open field, except those intended for the very earliest market, which are forced under glass. In the latter case the pickers are working in a very steamy atmosphere in shirt-sleeves, so that plenty of surface is exposed to the sap. In the fields the main crop is gathered towards the end of March, and in these islands the sun is quite strong enough even at that time of year to cause severe sunburn. The flowers and leaves are cut, and then made up in bunches usually of a dozen blooms each. An expert buncher handles a great many each day. The work is, of course, done entirely by hand, including the packing in flat baskets for shipment. Every opportunity is thus afforded for the hands and arms of the workers to come into contact with the cell-sap. Individual susceptibility seems to play a great part in the development of this dermatitis, since some workers escape entirely, others give a history of a single attack, while some are so extremely susceptible that they dare not handle the leaves or flowers. All are agreed, however, that anything which lowers the general bodily resistance, such as exposure to cold or damp for a long time, or any local injury, such as a bruise or sunburn, predisposes to an attack. According to Walsh, the rash is "an erythema of papular, vesicular, or pustular type, of varying degrees of severity, at times chronic, and in rare instances generalized." The precise nature of the irritant has not yet been determined. It was originally described as "Oil of Jonquil, (*sic*) by Bernard Smith, who ascribed this to all the members of the Amaryllidaceæ. No mention of this hypothetical "Oil of Jonquil" is to be found in chemical literature, and experiments made with it by Walsh showed that it was quite innocuous. Preparations of various kinds were made from several varieties, but when applied to the unbroken skin gave a negative result. The "succus," however, gave a positive result when applied to an area of skin which had been slightly abraded with a needle, producing an area of redness and swelling around the centre of inoculation. A strong alcoholic tincture had a similar though slighter effect. It is probable that the abundant raphides of calcium oxalate which are present in the sap might provide the abrasive action, without which the sap does not appear to affect the average person. The succus is said to act physiologically like a member of the Digitalin group, which may afford a clue to the nature of the toxic principle. The chief points of interest about this dermatitis are the apparent necessity of an abraded skin, and the variations in individual susceptibility.

"DISAPPEARING WILD FLOWERS."

THE *Times* has recently published several letters calling attention to the destruction of our wild flowers, and one which suggests a remedy as objectionable as the disease. In its issue of April 20 the correspondence is summarized in an article headed as above, which we reproduce:

"It is time that additional steps were taken to protect wild plants and flowers. Possibly many people to whom Devonshire seems the very home of primroses may have been surprised at the letter from the Bishop of Exeter, which we lately published, describing their disappearance in many parts of that as well as of other counties. There are very few primroses left within a line drawn round London, which is not quite equidistant at all points, but which averages about 25 miles radius. The roots have been dug up and sold in London, almost all to perish. For many years past the eradication of many species of ferns has been even more general; while certain plants which at all times were rare, such as the most local and conspicuous British orchids, have been almost completely extirpated. To see our rare plants in bloom must always be a pleasure for the comparatively few, though to allow any plant to be exterminated is an inexcusable offence against posterity But the destruction of primroses removes from the landscape of spring one of its delights with the most general appeal; and the effective enforcement of protective legislation should enlist the active support of every class. Even in areas such as public parks, where special prohibitions are in force, there has been increased defiance of them during and since the war, mainly owing to the diminution of effective supervision. Bluebells have hitherto suffered less than primroses, owing to their being less conveniently removed and transplanted. But from at least one London park, in the eastern suburbs, many bluebell plants were pillaged this year during the Easter holidays, while torn fragments were strewn on all sides. The suggestion of one of our correspondents that wild plants should be systematically disseminated by school children is open, unless very carefully controlled, to the objection of disturbing the natural floral associations, and to the risk of introducing new species which might become an aggressive pest. But where protective rules already exist, they should again be more effectively enforced; and they should be adopted and maintained with equal determination in rural areas where pillagers of roots, whether street-hawkers or collectors of the rarer species, have hitherto enjoyed a vicious immunity."

BOOK-NOTES, NEWS, ETC.

Newspaper Botany. The *Daily News*, which, as our last issue showed, occupies a prominent position among botanical blunderers, writes on April 12 that "wayside hedgerows and wastes are now getting to the stage when it is hardly possible to do anything but catalogue the wild flowers." The list given, however, is not extensive, but it includes the "white tormentil," with which we are not familiar. It also tells us that the wild arum is "ready to supply the cuckoo, when it comes, with a drink": according to the old folk-name, cuckoo-pint, it serves this useful purpose—a reference to Prior's *Popular Names* will dispel this illusion. On the following day in an article on "vegetables that grow wild," wherein various strange things were mentioned—*e. g.* "wild asparagus," which "we find in the young shoots of certain ferns—the royal fern is the really good one." There is also "*Anthyllis arvensis*, honourably known to Culpeper and the medical herbalists of to-day as parsley piert"; this grows in "dome-like clusters of tightly-packed green, rapidly reaching the dimensions of a football; you pull up each boss by the roots and soon have an armfull or even a cart load, which you can try and sell to the makers of liver-medicines, or your armfull you can boil for dinner." The writer adds "I have not yet tried it that way"; perhaps some of our readers can report.

But newspaper botany is likely to be eclipsed by the magazines, if the following, from *Nash's Magazine* for March (p. 537), which a correspondent sends us, may be taken as a sample:—"The hemlocks, clothed from head to foot in thin smoke and exquisite foliage, caught his attention. Usually they had the power to arouse his enthusiasm, for he considered them the most beautiful of all conifers. Now they reminded him only of the fact that Socrates had ended *his* troubles with a bowl of hemlock. He wondered if it could have been the same kind of hemlock. He thought not." We also think not.

At the meeting of the Linnean Society on April 15th, Mr. R. Paulson showed lantern-slides illustrating definite stages in the sporulation of gonidia within the thallus of the lichen *Evernia Prunastri* Ach. He stated that it has for a considerable time been generally accepted that the bright-green spherical gonidium, which is common to many lichens and is referred to in the literature of the subject as *Cystococcus*, *Protococcus*, or *Pleurococcus*, multiplies vegetatively only, while it remains the algal constituent of the lichen thallus. Famintzin (1868), Baranetzki (1868), Woronin (1872), Bornet (1873), and Chodat (1913), state that the gonidia (*Cystococcus*?) of certain lichens produce zoospores after being isolated from the gonidial layer and subsequently cultivated in, or on, different media. He had not been able to find that the gonidia of *Evernia Prunastri* and of twenty-three other species of lichens, representing eleven genera, divide vegetatively within the thallus, but in all these cases the reproduction of gonidia was found to be the result of the successive bipartition of the original protoplast of the cell into four, eight, or sixteen separate masses each of which rapidly develops a cell-wall of its own while within the mother cell. These daughter gonidia (suppressed zoospores?) ultimately escape as the mother-cell-wall becomes diffluent. They exhibit all the characteristics of the parent cell before they are set free.

"JOURNAL OF BOTANY" REPRINTS.

In view of the fact that the stock of these is in some cases practically exhausted, the attention of our readers is directed to the list which appears on the following page. Old subscribers of course already possess the matter contained in them in the pages of the *Journal*; but some of them appeared several years ago, and recent subscribers will thus not possess them. Some, which do not appear in the list, are already out of print; of others very few copies remain, and it will of course be impossible to reprint them: among the latter may be mentioned Mr. Riddelsdell's *Flora of Glamorganshire*, Mr. Dallman's *Notes on the Flora of Denbighshire* (1911), and Mr. Bennett's *Supplement to 'Topographical Botany.'* Of the Supplements to the *Biographical Index* no complete sets remain. It had been hoped before this to issue the second edition of the work, in which these Supplements are of course incorporated, but the present cost of paper and labour has rendered this impossible. Of the *Index* itself no copies remain, these having been lost in the course of transferring the stock to Messrs. Adlard. Mr. Garry's *Notes on the Drawings of Sowerby's 'English Botany,'* containing, as it does, much topographical information and numerous unpublished notes by Smith, Sowerby and others, should be in the possession of all interested in the history of British Botany: only sixteen copies remain.

It may be pointed out that, although for the most part relating to British Botany, certain of the reprints have a more general appeal. Such are the *Index Abecedarius*—a list of the plants in the first edition of Linnæus's *Species Plantarum*, showing at a glance what are included in that work, which has no index of species; the *History of Aiton's 'Hortus Kewensis,'* which contains much information as to the authors and contents of that classical work: the *Flora of Gibraltar*, which, besides a complete list, contains notes on the more interesting species; Linnæus's *Flora Anglica*—the first English Flora—has a bearing upon nomenclature: of all these there are numerous copies.

[*Over.*

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No. 690 JUNE, 1920 Vol. LVIII

THE JOURNAL OF BOTANY

BRITISH AND FOREIGN

EDITED BY

JAMES BRITTEN, K.C.S.G., F.L.S.

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LONDON

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THE

JOURNAL OF BOTANY

BRITISH AND FOREIGN.

EDITED BY

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THE JOURNAL OF BOTANY was established in 1863 by Seemann. In 1872 the editorship was assumed by Dr. Henry Trimen, who, assisted during part of the time by Mr. J. G. Baker and Mr. Spencer Moore, carried it on until the end of 1879, when he left England for Ceylon. Since then it has been in the hands of the present Editor.

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CHESHIRE ROSES.

By J. R. Matthews, M.A., F.L.S.

In the *Flora of Liverpool District* by Green (1902) it is stated that critical genera such as *Rubus* and *Rosa* were not revised by the committee entrusted with the preparation of a new edition of the Liverpool Flora. The account of the roses given in Green's Flora seems to be based to some extent on the earlier records published in Lord de Tabley's *Flora of Cheshire* (1899); these records, though revised and brought up to date with regard to nomenclature by the Rev. W. Moyle Rogers, represent largely the work of Webb, a well-known botanist and rhodologist, who resided in Birkenhead for several years, and who was chiefly responsible for the *Flora of Liverpool*, published by the Liverpool Naturalists' Club in 1872.

In a series of papers on the genus *Rosa*, published as Supplements to this Journal (1908, 1910, 1911), Colonel Wolley-Dod incorporates valuable notes on species and varieties collected in Cheshire, but the writer is not acquainted with any recent publication dealing especially with the Rose flora of this county.

The material which forms the basis of the following account was collected at odd intervals during the summers of 1917 and 1918 in the district known as the Wirral Hundred of Cheshire. The greater part of the area lies between lat. 53° 15′ and 53° 25′, and the highest point in the district is Heswall Hill, 360 feet. As might be expected, the boreal and montane elements of the British Rose Flora are rather scantily represented, but the area provides abundant material of those species having a more general distribution.

In the list which follows, I deal mainly with those Cheshire Roses I have myself seen or gathered, but I have also made considerable use of Colonel Wolley-Dod's notes on forms from the county in order that the list may present as full an account as possible of the roses occurring in the district under review. I have throughout attempted to give segregate names to the plants collected, although I have done so with considerable reserve for reasons I shall not attempt to discuss here. Forms not recorded in *Flora of Cheshire* or *Flora of Liverpool District*, nor given for v.c. 58 in *List of British Roses*, are marked with an asterisk, and are presumably additions to the county flora.

I am much indebted to my friend Mr. W. Barclay for kindly looking over my material and confirming my determinations.

R. ARVENSIS Huds. Abundant and widely distributed. *Var. *ovata* Lej. occasional; it seems to pass into the type, and it is doubtful if it is even varietally distinct. *Var. *erronea* Rip. in a lane near Greasby.

R. LUTETIANA Lém. Exceedingly common. An example from Meols has slightly hairy peduncles, and although Léman describes the peduncles as glabrous or naked, I am convinced the Meols plant must be placed to his species. Mr. Barclay agrees. Var. *sphærica* Gren. not uncommon. Var. *separabilis* Déségl. frequent. *Var. *flexibilis* Déségl. between Bromborough and Raby. Var. *senticosa* Ach. recorded for v.c. 58 by W.-Dod.

R. INSIGNIS Déségl. et Rip., which I have taken as the representative species of the *Transitoriæ*, is not uncommon. *Var. *syntrichostyla* Rip. near Brimstage. A plant from Greasby with narrow, beaked fruit seems to be referable to *var. *rhynchocarpa* Rip.

R. DUMALIS Bechst. Very common. Var. *leiostyla* Rip. near Greasby. *Var. *biserrata* Mér. near railway-crossing between Moreton and Meols. There has been some doubt regarding the occurrence of this plant in Britain. Mérat's description is certainly incomplete in some points, but if Déséglise's account can be accepted, the globose fruit, short villous styles, and ascending or erect sepals should distinguish the plant from other forms of *R. dumalis*. There is a sheet in Herb. Brit. Mus. (No. 44, Herb. Ley) from Brampton Abbots, Hereford, which agrees in most particulars with my specimens, but the sepals appear loosely reflexed, whereas the Cheshire examples have ascending, almost erect sepals. A Cheshire specimen collected by Wolley-Dod, referred to *R. biserrata* Mér. by Dingler and Sudre, "departs greatly from the type."

R. VERTICILLACANTHA Mér. "Upton Road. Between Moreton and Hoylake." *Flora of Liverpool District*. A specimen from Bradley Valley in Herb. Brit. Mus. (No. 1356, Herb. Wolley-Dod) is feebly characterized, since there are only one or two glands on a few of the peduncles. It therefore comes very near *R. dumalis*.

R. SCABRATA Crép. This name was employed by Crépin to cover a series of forms of *R. canina* L. having biserrate leaflets, subfoliar glands, and smooth peduncles. I have not found any such form in Cheshire, but a specimen collected at Cliffbank, Carden, in Herb. Brit. Mus. (No. 1441, Herb. Wolley-Dod), labelled *R. vinacea* Baker, comes under this series.

R. BLONDÆANA Rip. The following notes are quoted from Col. Wolley-Dod's account of the subsection Eu-caninæ, p. 63. "There are two British plants in this cover in herb. Déséglise. One is from West Kirby, Cheshire, by Webb, labelled by Mr. Baker '*R. arvatica*, excellent.' . . . . . Except for its glabrous midribs, this is really much nearer *arvatica* than *Blondæana*. . . . . . The other is also from Webb, collected at Hoylake, which is quite near West Kirby. It is a very similar-looking plant, but having hairy midribs is, I think, indisputably *R. arvatica* Baker." I confine the name *R. Blondæana* Rip. to plants of the *R. canina* group having biserrate leaflets, subfoliar glands, and hispid peduncles. The only Cheshire example I have seen is one by Wolley-Dod from Broxton quarry in Herb. Brit. Mus. It has large leaflets, not very strongly biserrate, a few glands on the primary veins beneath, and feebly glandular peduncles.

R. URBICA Lém. The commonest species of the group *R. dumetorum* Thuill. *Var. *semiglabra* Rip. not uncommon. A form of this variety with globose fruit Mr. Barclay thinks may be referred to *var. *globata* Déségl. Var. *sphærocarpa* Pug. near Brimstage. A plant from Raby Mere with very small leaflets only slightly pubescent beneath, and small, almost globose fruit, I cannot refer to any named segregate, and Mr. Barclay has not suggested a name.

It seems to approach var. *calophylla* Rouy, but is not identical with specimens so named in Herb. Brit. Mus.

R. ARVATICA Baker p.p. Although some confusion surrounds this name, I retain it, in the meantime, to cover the series of forms of the *R. dumetorum* group having biserrate leaflets. It seems perfectly clear what Baker meant by *R. arvatica* when he states in *Monograph of British Roses*, p. 229, that it "bears much the same relation to *urbica* that *dumalis* does to *lutetiana*." I have not encountered any rose in Cheshire that could be described as a biserrate *urbica*, but there is a specimen from Grange Farm in Herb. Brit. Mus. (No. 1455, Herb. Wolley-Dod) labelled *R. hemitricha* Rip. *teste* Dingler. Ripart describes his plant as differing from *R. urbica* "in its villous and glandular petioles and its doubly dentate leaflets." As Colonel Wolley-Dod points out, specimens are scarcely more than irregularly serrate, so they differ but slightly from forms of *R. urbica* Lém.

R. DESEGLISEI Bor. Duckington Wood. No. 1499, ex herb. Wolley-Dod in Herb. Brit. Mus.

R. GLAUCA Vill. sp. agg. This boreal or montane aggregate is very sparsely distributed in Cheshire.

R. CREPINIANA Déségl. = *R. Reuteri* God. A uniserrate form and the type of Villars's *R. glauca*. "Hedges of the fields between Moreton and Hoylake," *Flora of Liverpool District*.

*R. SUBCRISTATA Baker. This is the commonest form of the *glauca* group. I have it from between Newton and Hoylake, Brimstage, Thornton Hough, Raby, and Irby.

R. FUGAX Gren. Two plants, one from Raby Mere, the other near the bridge that crosses Arrow Brook between Moreton and Meols, are referable to this segregate, although the peduncles are rather feebly hispid.

R. CORIIFOLIA Fries sp. agg. Rare. Recorded in *Flora of Cheshire* as occurring in good quantity at West Kirby, and there is a specimen by Webb from this station in Herb. Déségl. Var. *frutetorum* Bess. and var. *implexa* Gren. are recorded for the county in *List of British Roses*.

*R. SUBCOLLINA Chr. Very rare. Extremely well-characterized specimens of this were obtained from a single plant between Bromborough and Raby. I am not certain that this is not a new record for England.

R. TOMENTELLA Lém. Not common. Specimens from four localities, all in the neighbourhood of Meols, show considerable variation in the density of the subfoliar glands, and it does not appear possible to distinguish varieties readily by different degrees of glandularity. The peduncles in my specimens are more or less hairy, and although Léman's key gives glabrous or naked peduncles for *R. tomentella*, I think the Meols plants must be referred to his species. The alternative is to place them to *R. Borreri* Woods, which has peduncles "with weak setæ or white hairs or even dense pubescence." But if large leaves and a lax habit are, as Wolley-Dod believes, distinguishing characters of *R. Borreri*, then my plants cannot be referred to that species. It would seem desirable to regard *R. Borreri* and *R. tomentella* as synonymous, as Crépin suggested so long ago as 1896.

R. RUBIGINOSA L. Green records a few plants above the Red Noses, New Brighton. A specimen from a bush growing in a hedge near Four Lanes End belongs to the *Rubiginosæ*, but as neither flowers nor fruit were obtained it cannot be referred with certainty to any named segregate.

R. MICRANTHA Sm. Recorded for Cheshire in *List of British Roses*.

R. MOLLIS Sm. The type and var. *cærulea* Woods are reported as rare in *Flora of Liverpool District*. I have seen neither, nor are they recorded for Cheshire by Wolley-Dod.

R. TOMENTOSA Sm. This is described by Green as frequent. I doubt very much the occurrence of real, typical *tomentosa* in the Wirral district at least. Considerable attention was given to this question, and no rose was discovered that could be referred with certainty to Smith's plant. Probably, much of what has been called *R. tomentosa* Sm. is, in reality, *R. omissa* Déségl., a species that has been considerably misunderstood by some British Botanists.

*R. OMISSA Déségl. Not infrequent, occurring chiefly on the higher ground. *Var. *submollis* Ley by the footpath from Brimstage to Thornton.

*R. SUBERECTA Ley. Near Irby, agreeing well with the author's description, although Ley's own specimens seem to vary considerably. *Var. *glabrata* Ley. Near Irbymill Hill.

R. SCABRIUSCULA Sm. Recorded for v.c. 58 in *List of British Roses*.

R. JUNDZILLIANA Baker. For an account of this plant, gathered originally by Webb, near Moreton, reference should be made to Baker's *Review of British Roses*, p. 21, and to Wolley-Dod's paper, *The British Roses*, p. 96.

R. PIMPINELLIFOLIA L. Abundant on the sandhills at Wallasey.

R. INVOLUTA Sm. sp. agg. Locally distributed. In considerable quantity in a field west of Moreton; in a hedge near the cross-roads at Four Lanes End; by the footpath between Brimstage and Raby. The fruit is almost universally abortive. All my gatherings are referable to *R. Sabini* Woods. From observations in the field and from the characters of the hybrid itself, I am inclined to the view that the second parent is always a form of *R. omissa*, which is the commonest species of the *Villosæ* section in the districts where the hybrid was noticed. Since *R. pimpinellifolia* is also common, there seems to be no reason to question the indigeneity of the hybrid as Green has done in *Flora of Liverpool District*.

R. HIBERNICA Templ. Rare. The type, which has pubescent leaflets, is reported to occur in the neighbourhood of Great Meols. Var. *glabra* Bak. A good colony on Irbymill Hill. It is, I think, *R. pimpinellifolia* crossed with one of the glabrous forms of *R. canina*. The leaflets are rather narrow, slightly acuminate, and quite uniserrate. In 1917 only one fruit matured on the bush at Irbymill, and on this the sepals ultimately became erect. It seems unlikely, however, that the second parent is a form of *R. glauca* Vill., which has erect or ascending sepals. This aggregate, as we have seen, is sparsely distributed in the district, while *R. canina* and its forms are abundant. Further, I can find nothing in the features of the hybrid itself to suggest a *glauca* parentage except the erect sepals, and this feature might well be derived from *R. pimpinellifolia*.

EAST WILTSHIRE BRYOPHYTES.

By Cecil P. Hurst.

(See Journ. Bot. 1916, 17, 266; 1918, 181.)

The following mosses and hepatics were observed growing around Great Bedwyn, near Marlborough in East Wiltshire, during 1918 and 1919. This locality continues to produce rare and interesting plants, the character of the country, woodland, water, marsh, meadow, and downland, and the diversity of soil, chalk, sand, and clay tending to produce a varied flora. Including subspecies and seven mosses occurring on sarsen stones near Aldbourne and Marlborough, which are situated a little distance away from our district, I have noted 184 mosses and 45 hepatics in the neighbourhood of Great Bedwyn; the present list records 74 mosses comprising 20 species and 6 vars. new to North Wiltshire and 3 species and 4 vars. which are new to South Wiltshire, and also includes 24 hepatics, 20 of which have been hitherto unrecorded for North and 6 for South Wilts. There is a tract of sandy ground in the north part of Tottenham Park bordering on Savernake Forest and rising to nearly 600 ft., which produces a very interesting moorland flora, rare in in this chalky country; here grow the mosses *Rhacomitrium canescens*, hoary greyish green in colour, and the conspicuously red-fruited *Funaria ericetorum*, while the hepatics *Sphenolobus exsectiformis* with its clusters of orange gemmæ and the typically moorland *Gymnocolea inflata* find a congenial habitat among the heather and the ground is white with lichens, the lichen flora including *Cladonia sylvatica*, *C. furcata*, *C. uncialis*, *C. coccifera*, *Cetraria aculeata* var. *hispida*, *Parmelia physodes*, a small state of which thickly encrusts the stems of the heather and *Bæomyces roseus* forming a pale-grey crust on the earth prettily relieved in the winter months by its pink fruits borne on slender stalks. The sandy clay strata of the Reading Sands are very prolific in interesting plants, and it is on this substratum in Chisbury Wood that many rare mosses and hepatics occur. Some noteworthy moss-records are *Philonotis cæspitosa* var. *adpressa* in a bog on Burridge Heath new to the British Islands, the fine var. *elatum* of *Mnium affine* growing luxuriantly on boggy ground in Hungerford Marsh, the curious form of *Mnium rostratum* with obsolete leaf-teeth which occur on the gravel of Rhododendron Drive, Savernake Forest, the rare *Amblystegium Kochii* plentiful and fruiting copiously in one place in an *Epilobium hirsutum* swamp at the source of the Shalbourne Stream near Shalbourne, the uncommon *A. varium* growing on brickwork by a pool at Crofton, and *Hypnum* *giganteum* in Hungerford Marsh, a relic of the primeval morass, the draining of which has reduced it to a small and impoverished condition, while interesting hepatics are the rare Crystalwort *Riccia bifurca* found on rides in Chisbury and Bedwyn Brails Woods, *R. commutata*, rather plentiful in a stubble field near Froxfield, it is a plant of comparatively recent introduction to the British hepatic flora, *Marsupella Funckii* forming blackish-brown tufts on a ride in Cobham Frith Wood, and the rare *Cephaloziella Limprichtii* growing on bare soil in Tottenham Park and Bedwyn Brails Wood. I paid a visit to a sarsen-strewn valley in West Woods. near Marlborough, hoping to find some of the aberrant sarsen-stone mosses which form such a conspicuous and interesting feature of the moss flora of the chalk-down valleys in the neighbourhood, but in this I was disappointed, for the sarsen stones were covered with a dense growth of *Bryum capillare*, *Hypnum cupressiforme*, and other common species, and with the exception of a little *Grimmia trichophylla*, the sarsen-stone species were conspicuous by their absence; Mr. Dixon wrote:—"I surmise that the special sarsen-stone species are rather markedly xerophytic and get a hold on stones in the open where other mosses find it difficult to live, but that in the wooded valley you refer to there is more shade or moisture, so that these commoner species have got their footing and excluded the Grimmiaceæ, etc. But this is rather guess-work." The following twenty-nine mosses, which are generally uncommon or rare with capsules, I have found fruiting around Great Bedwyn:—*Campylopus flexuosus*, *Barbula Hornschuchiana*, *Zygodon viridissimus*, *Orthotrichum Lyellii*, *Philonotis fontana* (a single capsule), *Webera annotina*, *Bryum pallens*, *B. pseudo-triquetrum*, *Mnium affine* var. *elatum* (a single seta), *Neckera pumila*, *N. complanata*, *Pterogonium gracile*, *Thuidium tamariscinum*, *Brachythecium albicans*, *B. rivulare*, *B. illecebrum*, *B. purum*, *Eurhynchium speciosum*, *E. Swartzii*, *E. pumilum*, *Plagiothecium silvaticum*, *Amblystegium Kochii*, *A. filicinum*, *Hypnum stellatum* var. *protensum*, *H. fluitans* var. *gracile* (two capsules), *H. cordifolium*, *H. Schreberi*, *Hylocomium splendens*, and *H. squarrosum*. Mr. Nicholson writes:—"The list of fruiting-mosses which you send me is no doubt a very good one for a limited locality, but I am inclined to think it bears more testimony to your careful search than to any very exceptional conditions in your district; I have found all but four fruiting in Sussex, and I think all somewhere. No doubt warmth assists some of the distinctly southern species to fruit, such as *Zygodon viridissimus*, *Barbula Hornschuchiana*, and *Pterogonium gracile*, which are abundant and fruit freely in the Mediterranean region, but most of your plants are rather northern, and a suitable degree of humidity is perhaps the most essential condition." *The Census Catalogues of British Mosses* (1907) *and Hepatics* (1913) have been followed in recording the following plants, and my best thanks are due to Messrs. H. N. Dixon, W. Ingham, H. H. Knight, W. E. Nicholson, and J. A. Wheldon for interesting notes and much kind assistance in identification; Mr. Nicholson's letters regarding the rare Chisbury Wood *Fossombronia Crozalsii* and *Husnoti* var. *anglica* are, especially, of very great interest. 7 = North Wilts; 8 = South Wilts; c.fr. = with fruit; * = new vice-comital record.

MOSSES.

Sphagnum cymbifolium Ehrh. 8. In a small pool near Foxbury Wood.

Catharinea tenella Röhl. 7*. Rather sparingly on the sandy clay of the Reading Sands on a ride in Chisbury Wood; the plants were sterile. This is extremely rare and seems to be recorded only from Bedgebury Wood, Goudhurst, Kent.

Polytrichum piliferum Schreb. and *P. juniperinum* Willd. 7, 8. Not uncommon in sandy places in Savernake Forest and Tottenham Park,

Pleuridium axillare Lindb. 7, 8. Abundant on the insides of cart-ruts in Bedwyn Brails and Chisbury Woods and damp places in Savernake Forest, always fruiting.—*P. subulatum* Rabenh. 7, 8. C.fr., abundant on sandy ground in the district.

Dicranella rufescens Schp. 7*. On damp clay by a pool near the Column, Savernake Forest, c.fr.—*D. varia* Schp. 7, 8. Widely spread, often on the bare surface of the chalk.—*D. Schreberi* Schp. 7*. Chisbury Wood, with *Pleuridium subulatum.*

Campylopus flexuosus Brid. 7. Fruiting in the north part of Tottenham Park and also in Rhododendron Drive; capsules appear to be rare in this species.—*C. brevipilus* B. & S. 7*. In very small quantity in the north-east part of Tottenham Park, near the Grand Avenue (*teste* Knight).

Dicranum Bonjeani De Not. 7. In small quantity in the north part of Tottenham Park.

Leucobryum glaucum Schp. 7. Rather sparingly in one place in Chisbury Wood; also in Cobham Frith Wood.

Fissidens exilis Hedw. 7*. On clay in Chisbury Wood.—*F. crassipes* Wils. 7*. C.fr., on the brickwork of a sluice by the Kennet and Avon Canal; also in a similar situation by the Kennet near Ramsbury.

Grimmia trichophylla Grev. 7. On sarsen stones in West Woods, Marlborough.—*G. subsquarrosa* Wils. 7. A form almost without hairpoints on sarsen stones in Lockeridge Dean, Marlborough. This is extremely rare in fruit; as to its method of propagation, Mr. Dixon wrote:—"This frequently, if not normally, has multicellular gemmæ in the axils of the upper leaves, and I expect the propagation is chiefly by these: in fact, Limpricht gives '*G. subsquarrosa*' as a synonym of his '*G. Mühlenbeckii* forma *propagulifera*.'"

Rhacomitrium canescens Brid. 7*. In small quantity on earth in the north part of Tottenham Park.

Pottia intermedia Fürnr. 7, 8. Plentifully in a fallow field at Fosbury; Savernake Forest.—*P. minutula* Fürnr. forma. 7. On the ground near Savernake Lodge; "a form with rather narrow and elongate capsules." Dixon.

Tortula lævipila var. *lævipilæformis* Limpr. 7*. On trees in Tottenham Park, near the Durley Gate.—*T. papillosa* Wils. 7.

Tree near Chisbury Wood; thinly scattered throughout the district on trees, rarely on stone.

Encalypta streptocarpa Hedw. 7. Chalky bank near Ramsbury.

Orthotrichum pulchellum Smith. 7. In small quantity on old elder near Rhododendron Drive, Savernake, c.fr.

Ephemerum serratum Hamp. 7*, 8*. C.fr., on bare spaces in Savernake Forest, etc.—*E. serratum* var. *angustifolium* B. & S. 7*. C.fr., on sandy clay in Chisbury Wood.—*E. sessile* var. *brevifolium* Schp. 7*. C.fr., on sandy clay soil in Chisbury Wood. The *Census Catalogue* records this only from East Sussex and Cheshire.

Physcomitrella patens B. & S. 7*, 8*. Upon drying mud on the downs near Tidcombe, S. Wilts, near Polesdown's Farm, Shalbourne; near Stype Wood and Chisbury Wood.

Funaria ericetorum Dixon. 7*. C.fr., heathy ground in the north-east part of Tottenham Park.

Philonotis fontana Brid. 7, 8. Abundant all over Savernake Forest; occurring plentifully in Tottenham Park, but without flowers or fruit.—*P. cæspitosa* Wils. 8. Producing male flowers freely in a bog on London Clay near Burridge Heath; the capsules have not been found in Britain.—*P. cæspitosa* var. *adpressa* Dismier. 8*. Sparingly with type in a bog near Burridge Heath, new to the British Isles; it is curious that this and *P. calcarea* var. *laxa* Dismier should be almost confined to the neighbourhood of Great Bedwyn. I have traced the latter into Berkshire, where it grows by the side of the Kennet and Avon Canal at Hungerford.

Webera nutans Hedw. 7*. On sandy soil in Chisbury Wood; heathy ground in the north part of Tottenham Park, c.fr.—*W. annotina* Schwaeg. 8. Dod's Down Brickworks, where it fruits freely.—*W. annotina* var. *erecta* Correns. 7. Widely spread in Savernake Forest; the brown ovate gemmæ in the axils of the upper leaves in this var. are so large that they push the leaves outwards.—*W. carnea* Schp. 8. On wet clay in Chisbury Wood; very plentiful on the clayey sides of the Shalbourne Stream between Hungerford and Shalbourne; also on clay at Merle Down Brickworks.

Bryum pseudo-triquetrum Schwaeg. 7*, 8. Fruits sparingly in a small bog near Webb's Gully Wood, and more freely in a wet piece of ground in Hungerford Marsh.—*B. cæspiticium* L. 7. C.fr., on a wall at Marlborough.—*B. erythrocarpum* Schwaeg. 7*. C.fr., sandy ground in Chisbury Wood, with radicular crimson translucent multicellular gemmæ which extended sparingly along the lower part of the branches.—*B. atropurpureum* Web. & Mohr. 8*. Cfr. Sandy ground near Folly Farm (the type). *B. murale* Wils. 7, 8. C.fr., walls at Shalbourne, Oxenwood, and near Rudge Manor, Froxfield; not uncommon on mortar of walls.

Mnium affine var. *elatum* B. & S. 7*. Plentifully on very wet ground in Hungerford Marsh.—*M. rostratum* Schrad. forma. 7. A form with edentate leaves occurred on the gravel of Rhododendron Drive; Mr. Dixon wrote:—Your form of *Mnium rostratum* is a very marked one; I do not remember to have seen it with leaves practically entire."—*M. punctatum* L. 7*. Sandy ground in Chisbury Wood.

Leucodon sciuroides Schwaeg. 7. In Savernake Forest, with the numerous gemmiform branchlets which are mentioned in Dixon's *Student's Handbook* (p. 465).

Leskea polycarpa Ehrh. 7, 8. C.fr., by a watercourse near Little Bedwyn.

Anomodon viticulosus Hook. & Taylor. 7, 8. Widely spread around Great Bedwyn.

Thuidium tamariscinum B. & S. 7. I found about half a dozen capsules in a wood near Savernake Lodge.—*T. Philiberti* var. *pseudo-tamariscinum* Limpr. 8*. By roadside near Botley Down.

Climacium dendroides Web. & Mohr. 7*, 8. Boggy ground by railway north of Stagg's Lock on the K. and A. Canal. V.c. 7.

Brachythecium albicans B. & S. 7. Fruiting copiously on thatch by London and Bath Road near Hopgrass Farm, Hungerford.—*B. rutabulum* B. & S. 7. With capsules about as large as those of *B. velutinum* in a hedgebank near Chisbury Camp.

Eurhynchium piliferum B. & S. 7, 8. Widely spread among short grass throughout the district, but always sterile.—*E. Swartzii* Hook. 8. A form approaching to var. *rigidum* Boul. occurred near Merle Down Brickworks.—*E. pumilum* Schp. 7. In a shady place on the ground at Chisbury Camp.—*E. curvisetum* Husn. 7. C.fr., in three or four places by the side of the Grand Avenue, Savernake Forest.—*E. striatum* B. & S. 7. C.fr., in a wood near Savernake Lodge, the only place where I have seen it with capsules. —*E. murale* Milde. 7. Stone by side of London and Bath Road near Woronzoff Lodge, Savernake Forest, etc. Scarce and stunted in this district.

Amblystegium Kochii B. & S. 8. In considerable quantity and fruiting copiously in an *Epilobium hirsutum* swamp at the source of the Shalbourne Stream.—*A. varium* Lindb. 7*. On brickwork by water at Crofton Engine House.—*A. filicinum* De Not. 7. Fruiting in Hungerford Marsh.

Hypnum riparium L. C.fr., by water in Chisbury Wood.—*H. stellatum* var. *protensum* Röhl. Plentiful in bog near Webb's Gully Wood.—*H. chrysophyllum* Brid. 8. Clayey meadow upon Conyger Hill.—*H. aduncum* group *typicum* forma *falcata* Ren. 7*, 8*. Very sparingly with the previous species; "characteristic forma *falcata*," J. A. Wheldon; also in N. Wilts on marshy ground to the north of the K. and A. Canal between Little Bedwyn and Froxfield.—*H. aduncum* group *Kneiffii* var. *polycarpon* Bland. 8. By the margin of a dewpond on the downs near Tidcombe. *H. aduncum* group *Kneiffi* var. *intermedium* Schp. 8*. Plentifully in a pool forming part of Wilton Water; "typically var. *intermedium*," J. A. Wheldon.—*H. aduncum* group *Kneiffii* var. *intermedium* forma *penna*. 8*. Pool on London Clay at Dod's Down.—*H. fluitans* var. *Jeanbernati* Ren. 7*. In small quantity by pool near the Column, Savernake Forest; Mr. Wheldon writes:—"The *Hypnum* is fairly typical *Hyp. fluitans* var. *Jeanbernati*. The nerve is wide, but still within the range of *Jeanbernati* and not reaching the diameter of that of *atlanticum*, and the cell-structure is quite typically that of var. *Jeanbernati*; it is a small example of this variable var."—*H. falcatum* Brid. 7*. Bog in Hungerford Marsh near the Bedwyn Brook.—*H. Patientiæ* Lindb. 7*. A very small form on sandy clay in Chisbury Wood.—*H. stramineum* Dicks. 7*. A form with spreading distant leaves grew submerged very sparingly with *H. fluitans* var. *gracile* in a pool which dries up in the summer on peaty soil at about 550 ft. in Chisbury Wood.—*H. giganteum* Schp. 7*. Very sparingly in Hungerford Marsh growing with *Mnium affine* var. *elatum*: this is probably a relic of a time when Hungerford Marsh was in a much wetter and more undrained condition.

Hepatics.

Riccia bifurca Hoffm. 7*, 8*. Sparingly on rides in Chisbury and Bedwyn Brails Woods (*teste* Nicholson); the *Census Catalogue* records it from only seven vice-counties. *R. commutata* Jack. 7*. Plentiful in a stubble field by the London and Bath Road near Froxfield with *R. sorocarpa* and *R. glauca*.—*R. glauca* L. 7*. Stubble field near Froxfield, also in Savernake Forest. *R. sorocarpa* Bisch. 7*, 8*. Not uncommon on damp earth throughout the district, easily recognized by its bluish-green colour and deeply-furrowed frond.

Conocephalum conicum (L.) Dum. 8. Very fine on the brickwork of a sluice near Shalbourne; on brickwork inside the Bruce Tunnel on the K. and A. Canal at Savernake.

Pellia Fabbroniana Raddi. 7, 8. Common on damp ground, and in very wet places throughout the district; this species generally affects calcareous soil; the furcate apices of the thallus are a conspicuous character in autumn and winter.

Fossombronia pusilla (L.) Dum. 7*, 8. Plentiful on the insides of a cart-rut and in other places in Chisbury Wood; also in Foxbury Wood.—*F. Wondraczeki* (Corda) Dum. 7*. Chisbury Wood and on damp clay by the side pool near the Column, Savernake Forest.—*F. Husnoti* var. *anglica* Nicholson. 7*. In considerable quantity on sandy clay upon rides in Chisbury Wood; very rare plant: confirmed by Mr. Nicholson.—*F. Crozalsii* Corb. 7*. A plant bearing a single capsule on sandy clay soil in Chisbury Wood; Mr. Nicholson writes:—"Mr. Macvicar seemed to be quite satisfied about the *Foss. Crozalsii*, so I think you would be justified in recording it. I am inclined to agree with Mr. Macvicar that it is rather close to *F. Wondraczeki*. *F. Crozalsii* was recorded by me as a British plant from the Lizard in Journ. Bot. 1917, p. 10; the identification was confirmed by M. Douin, but the plant was not quite typical, and your plant agrees better with the type than mine."

Marsupella Funckii (Web. et Mohr.) Dum. 7*. In fair quantity in one place, Cobham Frith Wood, near Knowle Farm, Savernake.

Alicularia scalaris (Schrad.) Corda. 7*. Heathy ground in the north part of Tottenham Park.

Gymnocolea inflata (Huds.) Dum. 7*. In some quantity in one place on heathy ground in the north part of Tottenham Park.

Lophozia turbinata (Raddi) Steph. 7*. In small quantity in a chalk-pit by a roadside near Ramsbury.—*L. bicrenata* (Schmidt) Dum. 7*. On sandy ground on a ride near the Column, Tottenham

Park; also on a ride near Eight Walks, Savernake Forest; it can be recognized by its scent.

Sphenolobus exsectiformis (Breidl.) Steph. 7*. In rather small quantity among heather in the north part of Tottenham Park; the orange gemmæ which are thickly clustered on the leaf-apices give this plant a tawny appearance.

Chiloscyphus pallescens (Ehrh.) Dum. 8*. Very wet place in Bedwyn Brails Wood; by a rivulet in Foxbury Wood; bog near Burridge Heath; previously erroneously recorded as *C. polyanthus*, not yet found in Wiltshire.

Cephalozia bicuspidata (L.) Dum. 7*, 8. North part of Tottenham Park, with perianths; small form in Foxbury Wood.

Cephaloziella byssacea (Roth.) Warnst. 7*, 8*. North part of Tottenham Park; Chisbury Wood, with perianths; on clay at Dod's Down Brickworks; Foxbury Wood.—*C. integerrima* (Lindb.) Warnst. 7*. Some small colonies on the sandy clay of the Reading Sands upon rides in Chisbury Wood, with perianths; this is only recorded from Sussex.—*C. stellulifera* (Taylor MS.) Schiff. 7*. North part of Tottenham Park; also on sandy clay in Chisbury Wood.—*C. Limprichtii* Warnst. 7*, 8*. On earth upon a walk in the north part of Tottenham Park; also upon a ride in Bedwyn Brails Wood (*teste* Knight and Nicholson).

Scapania irrigua (Nees) Dum. and *S. curta* (Mart.) Dum. 7. Rather frequent in Savernake Forest on rides.

Microlejeunea ulicina (Tayl.) Evans. 7*, 8*. Rather common on beeches near Rhododendron Drive, Savernake Forest; on beeches in a copse near Ramsbury and in Foxbury Wood.

Frullania Tamarisci (L.) Dum. 7. On sarsen stones in the "Valley of Rocks" near Marlborough.

NEW MALAYAN PLANTS.

By H. N. Ridley, M.A., F.R.S.

Peripetasma Ridl., n. gen. (*Menispermaceæ*).

Frutex gracilis scandens glabra. *Folia* alterna subherbacea elliptica oblonga cuspidata trinervia. *Paniculæ* axillares racemorum longorum gracilium. *Flores* copiosi parvi pedicellis gracilibus. *Sepala* 6 in seriebus duabus ad basin connata lanceolata acuminata, exteriora angustiora crassiora. *Stamina* 6 libera filamentis ad bases incrassatis superne gracilibus arcuatis, antheræ loculis discretis. *Pistillodium* minimum triquetrum.

P. polyanthum Ridl., species unica. *Folia* basi rotundata nervis tribus a basi, nervulis e costa 6 paribus cum reticulationibus laxis subtus elevatis, 15 cm. longa, 5 cm. lata, petiolo 2·5 cm. longo. *Panicla* rachide 5–10 cm. longo, racemis 20–22·5 cm. longis pendulis. *Flores* dissiti parvi, pedicellis 2 mm. longis. *Bracteæ* dimidio æquantes. *Sepala* 6 ad basin in tubo campanulato connata lobis longis acuminatis bicostatis puncticulatis. *Stamina* breviora vix tubum superantia arcuata.

In sylvis ad Kwala Lumpur and Batu Tiga in ditione Selangor, Fl. Feb.–March (*Ridley* 11934).

This curious plant, of which I have only seen male flowers, seems to be most closely allied to *Tinospora*. It is chiefly peculiar in having the sepals in 2 series, or they may be considered one series of sepals and one of petals connate in a short tube, and with a minute triquetrous pistillode in the centre. The three-nerved leaves and long-pendulous racemes in panicles give it a curious appearance. I have twice met with it in Selangor—first in the Batu Tiga district, now quite denuded of its original flora by the rubber cultivation, and a second time in a wood near Kwala Lumpur.

Tinospora Curtisii Ridl., n. sp.

Scandens. *Folia* subcoriacea ovata ad basin breviter cordata, apicibus mucronulatis, nervis 3 paribus, subtus cum reticulationibus elevatis 10 cm. longa, 7·5 cm. lata, petiolis 2·5 cm. longis. *Inflorescentia* laxe et parce paniculata ramis 9 cm. longis vel brevioribus. *Flores* 3 mm. late singuli cum paucis racemosis. *Bracteæ* minutæ acuminatæ. Pedicelli triplo longiores. *Sepala* 3 rotundata lata. *Petala* 5 longiora lanceolata acuminata, stamina 6 filamentis brevibus latis liberis, antheri subglobosis. Flores fœminei et fructus desunt.

Penang, Batu Feringhi, near the beach, March 1900, *Curtis* 3464.

This has the characteristic pale fawn-coloured loose bark with warts common to most species of the genus. The leaves are more coriaceous than in any species known to me, and nearly entire at the base instead of being conspicuously cordate or truncate. The nerves of the leaf are nearly all pinnate, the lowest pair, however, being nearly opposite and running halfway up the leaf parallel to the margin. The inflorescence is minutely puberulous and has more of the character of a *Diploclisia*. The species is nearest perhaps to *T. uliginosa* Miers; the flowers are as large as those of that species, but on longer pedicels, and the leaves are quite different. A plant collected by Mr. C. B. Clarke at Decca in South India closely resembles this and may perhaps be identical with it.

Scaphocalyx Ridl., n. gen. (*Flacourtiaceæ*).

Arbores glabri. *Folia* alterna trinervia. *Flores* unisexuales in fasciculis lateralibus in ramis, parvi pedicellati. *Calyx* petala primo tegens in uno latere dehiscens vel in lobis 4 brevibus dehiscens. *Petala* 5 angusta breviter ad basin connata calyce æquantia vel superantia angusta, stamina 6, filamentis brevibus, antheris longioribus. *Pistillŏdium* nullum. Flores fœminei desunt. *Bacca* magna subglobosa laticifera, stigmatibus sessilibus 6–8. *Semina* plura irregulariter in pulpo dispersa.

Species 2. Peninsula Malaica.

This genus belongs to the *Flacourtiaceæ* and is allied to *Hydnocarpus*, which the plants resemble in habit and especially in the fruit. The trees appear to be altogether unisexual, which, however, is not unusual in this group, and the stamens are fewer than is usual. The curious spathaceous somewhat leathery calyx which eventually dehisces into a boat-like organ in one species and breaks up at the tip into 4 lobes in the other recalls *Trichadenia* and allied genera.

S. spathacea Ridl., n. sp.

Arbor parva 10–25 pedes alta. *Folia* alterna coriacea elliptica oblonga basi cuneato, apice acuminato, trinervia, costa supra elevata, subtus trinervia a basi elevata, nervis lateralibus circiter 18 paribus subhorizontalibus, nervulis ferme æque prominentibus 15–20 cm. longa, 5–7·5 cm. lata, petiolo 3 mm. longo. *Flores* masculi in tuberculis in ramis pedunculis brevissimis sericeis, pedicellis gracilibus 1·5 cm. longis. Alabastra fusiformia. *Calyx* spathacea rostrata cymbiformis in uno latere dehiscens 2 cm. longa. *Petala* ad basin connata linearia acuminata, stamina filamentis brevissimis petalis oppositis hirtis, antheris linearibus acuminatis, petalis dimidio æqualibus. Flores fœminei ignoti. *Bacca* globosa alba 2·5 cm. crassa. Stigmata 6–8, semina plura.

Malacca, Bukit Kamuning, *Derry* 1023; Negri Sembilan, Tampin Hill, *Goodenough, Burkill*; Selangor, Ulu Gombak, *Ridley* 142; Weld's Hill, *Abdul Rahman*.

S. parviflora Ridl., n. sp.

Arbor parva, ramis angulatis. *Folia* ovata elliptica acuminata trinervia basi cuneato, nervis exterioribus in parte superiore folii cum nervulis 13 paribus a costa anastomosantibus, 22·5 cm. longa, 10 cm. lata, petiolo 2 mm. longo. *Flores* in fasciculis parvis supra axillaribus, pedicelli 3 mm. longi. *Calyx* spathacea in 4 lobis acuminatis pilis terminatis fissa 4 mm. longa. *Petala* 4 breviora alba lanceolata acuta. *Stamina* 6 antheris lanceolatis basibus retusis filamentis brevissimis.

Perak, in sylvis Temengoh, *Ridley* 14736.

The foliage much resembles that of the previous species, but is larger and more ovate in outline. The flowers are very much smaller on short pedicels, the petals hardly longer than the calyx which splits into 4 points, the stamens are lanceolate and shorter than the petals.

PLANTAGO ALPINA AND P. MARITIMA.

By H. W. Pugsley, B.A.

The points of distinction between *Plantago alpina* L. and *P. maritima* L., the dwarf shore and mountain forms of which often bear a close resemblance, when in flower and fruit, to the alpine species, are not well marked and usually not very clearly described. When the plants begin growth in the spring, however, their aspect is entirely different, and it may therefore be worth recording their features as seen at this early season.

These notes are taken (23 February) from plants that I have under cultivation, as follows:—*P. maritima*, obtained from Poole Harbour in 1913; *P. alpina*, from Mürren, in the Bernese Oberland, in 1914; and an inland form of *P. maritima*, from hills near Crianlarich, Perthshire, in 1915. In all three cases the plants examined are those originally collected, so that they are all evidently fairly long-lived perennials.

P. maritima, from Poole, has grown into a dense tuft, with many erect, closely-matted branches, on which last year's dead leaves and peduncles, and brown leaf-sheaths from previous years remain. The earliest two or three leaves of the new season's growth, which has but lately commenced, are subulate, about 12 mm. long and less than 1 mm. broad, suberect, fleshy, nerveless, obscurely channelled above, and with an abruptly dilated base sheathing the stem. The next leaves are much longer, linear, subacute, soon attaining 10 cm. in length, but scarcely exceeding 2 mm. in breadth. They possess similar basal sheaths, and become successively more involute rather than channelled, and recurved towards the apex. They still show no definite midrib. At about the seventh leaf the denticulate margin sometimes appears.

In *P. alpina* the rootstock is divided into horizontally spreading branches, which are naked and scarred from the decay and disappearance of the previous year's foliage. The leaves do not sheathe the stem as in *P. maritima*, and the first ones, which appear some weeks earlier than those of *P. maritima*, are triangular-ovate, 5–6 mm. long and 4 mm. broad near the base, acute or acuminate, flat and herbaceous, distinctly 3-nerved, and spreading or slightly recurved in a small rosette. These earliest leaves are fugitive and are quickly followed by numerous others, which are linear-lanceolate in form, 2·5–3 cm. long and 6 mm. broad below the middle, acute, flat above and carinate underneath, with 3 distinct nerves, and the margins sometimes distantly denticulate. These leaves soon become spreading-reflexed, covering the shorter primordial ones and forming a dense rosette. While in January a tuft simulates a miniature *P. major*, at this date the resemblance lies with *P. lanceolata*.

The *P. maritima* from Crianlarich, though much dwarfer, is essentially identical with the Poole Harbour plant, showing the same erect branching and similar persistent leaf-sheaths. Its early leaves are linear-subulate, 15–20 mm. long and about 1 mm. broad, obtuse, nearly erect, fleshy, nerveless, but flat above and neither channelled nor involute.

With the advance of spring the leaves of *P. alpina* become longer (4–5 cm.) and relatively narrower, till at length they are not easily distinguishable from those of the Crianlarich *P. maritima*, which by that time form a spreading rosette. Both plants then have a quite different aspect from the Poole *P. maritima*, which continues to produce throughout the summer suberect leaves that may attain 25 cm. or more in length.

In my garden *P. alpina* flowers earlier and much more sparingly than the other two plants, and does not develop fruit. The two forms of *P. maritima* produce abundant fruit, but as no seedlings have ever appeared in their vicinity, I doubt whether any seed is perfected.

EUGENIA LUCIDA Banks.

By James Britten, F.L.S.

The presentation by Mr. E. D. Merrill to the library of the Department of Botany of a copy—one of the six prepared—of his type-written *Commentary* on Loureiro's '*Flora Cochinchinensis*' has impelled me to make a list of Loureiro's plants in the National Herbarium, adding such notes upon Mr. Merrill's admirable work as the specimens suggest. The list is not yet ready for publication, but in the course of its preparation I have come upon a small matter that, relating as it does to a plant unconnected with Loureiro and involving the correction of an error published in the first volume of this Journal, which has led even Mr. Merrill astray, may as well be printed now.

In this Journal for 1863 (p. 280) Seemann, writing of Loureiro's genus *Opa*, cited as synonyms of his *O. odorata*, *Syzygium odoratum* DC. and *S. lucidum* Gaertn., adding that authentic specimens of Loureiro's plant were in the British Museum. If this synonymy had been accurate, Gaertner's name for the species, as being the oldest, would undoubtedly stand, although I do not think the plant could be called *Eugenia lucida* Banks, as Gærtner published it as *Syzygium*, citing Banks's herbarium name as a synonym.

Mr. Merrill, accepting Seemann's determination, as, in view of the reference to Loureiro's specimens, he was justified in doing, takes up *lucida* as the trivial name, citing *Opa odorata* Lour. and *S. odoratum* DC. as synonyms. Gaertner's plant, however, which was only known from his description and figure, was cited by De Candolle (Prodr. iii. 17; 1828) with an expression of doubt; Hooker and Arnott (Bot. Beech. 187) also quote *S. lucidum* doubtfully under their *S. odoratum*, which they say "agrees much better with the description given by Loureiro than with the character of De Candolle." A discussion of *S. odoratum* is, however, beyond my present purpose, which is to clear up the confusion which has surrounded *S. lucidum*.

The promulgation of the erroneous identification is due to Seemann, who cites positively what De Candolle had regarded as doubtful. Seemann was by no means a careful worker, and often took his references at second hand; he must have done in this case, for had he referred to Gaertner's figure of the fruit of *S. lucidum* (t. xxxiii), he would have seen that it could not belong to Loureiro's *Opa odorata*.

In this Journal for 1899 (p. 248) I have given the history of Gaertner's plant, the sheet containing which had lain unnoticed in the Banksian herbarium for more than a hundred years until I found it among unidentified species at the end of *Eugenia*. It was not seen by Bentham when engaged on the *Flora Australiensis*—his investigation of the National Herbarium was always somewhat perfunctory, and was practically limited to an examination of the arranged species from Banks and Solander and of Robert Brown's herbarium, which at that period was Bennett's private property and so was not incorporated in the general collection. The sheet, which is endorsed in Dryander's hand "New South Wales: Endeavour's River. J. B." (Banks) bears the names, also written by him, "*Eugenia lucida*

New Holl. MSS. (*Syzygium lucidum* Gaertn.)." The original MSS. relating to Banks's Australian collections contain a full description of the plant by Solander, the names quoted above having been added by the ever-careful Dryander. For the botanical history of the plant, which was not refound until 1891, reference must be made to my paper above, where it is identified with *Myrtus nitida* Gmel. (1791), Gaertner's earlier name *lucida* (1788) being preoccupied in *Myrtus.*

SHORT NOTES.

ŒNANTHE CROCATA L. The *Irish Naturalist* for February contains an interesting paper by Mr. C. B. Moffat in which he discusses the character of *Œnanthe crocata* as a poisonous plant. A summary of the opinions of various writers, published in *Nature* for July 4, 1918 (p. 354), shows that "they all agree in pronouncing every part of the plant virulently poisonous"; yet careful experiments undertaken by Sir Robert Christison, while proving its virulence as grown near Woolwich and near Liverpool, showed that as grown near Edinburgh it was devoid of toxic properties. Mr. Moffat observed that in 1918 and 1919, at Ballyhyland, Co. Wexford, "three different herds of cows were found to make a regular practice of eating [it], not as a last resource, but as a favourite article of diet," of which "they made a substantial meal" with no disastrous results. In another locality, the deaths of cows were traced to the roots of the plant, but their poisonous nature has never been called in question. The account of the poisoning of "a Dutchman" which Threlkeld, as quoted by Mr. Moffat, epitomizes, will be found in Phil. Trans. xv. 84 (1698); it was in the first instance sent by Francis Vaughan to Ray, who sent it to Sloane (see *Correspondence of Ray*, p. 313). The "classical instance" relating to the poisoning of boys by eating the roots is well known, but it may be worth while to quote the case of the Dutchman in full: "There was also a Dutchman, about two years [since], within eight miles of this place [Clonmel, Co. Tipperary], poisoned by boiling and eating the tops of this plant shred into his pottage; he was soon after found dead in his boat, and his little Irish boy gave accounts of the cause of his death to be eating this herb, which he forewarned his master against, but in vain, the Dutchman asserting that it was good salad in his country." Ray refers to other cases "of the miserable destruction of divers persons by the eating of the roots of this pernicious and deleterious plant," but does not mention another in which the foliage produced fatal results. Lightfoot, however (Fl. Scotica, 163; 1777), says "The roots and leaves are a terrible poison; several persons have perished by eating it thro' mistake, either for water-parsneps or for celeri, which last it resembles pretty much in its leaves." He adds a note regarding Ehret, which is of interest: "So extremely deleterious is its nature, that I remember to have heard the late Mr. Christopher D. Ehret, that celebrated botanic painter, say, that while he was drawing this plant, the smell or effluvia only rendered him so giddy that he was several times oblig'd to quit the room, and walk out in the fresh air to recover himself; but recollecting at last what might probably be the cause of his repeated illness, he opened the door and windows of his room, and the free air then enabled him to finish his work without any more returns of his giddiness."—JAMES BRITTEN.

ASPIDIUM GOGGILODUS Schkuhr. In 1809 Schkuhr (Kr. Gew. i. 193) published as *Aspidium goggilodus*, a fern which Robert Brown described in the following year (Prodr. 148) as *Nephrodium unitum*. Schkuhr's specific name has now taken precedence, but has been changed to *gongylodes*—as it seems to me, wrongfully. The author was, of course, in error in his spelling, which should have been *gongylodus*, but the substitution of *e* for *u* is arbitrary and misses the whole point. I take it that Schkuhr's name was made up of the two words γογγύλος, rounded, and ὀδούς, tooth, whereas *gongylodes* can only represent γογγυλώδες (γογγυλο -ειδής), roundish. The plant is not at all "roundish," but its lobes or teeth are certainly "rounded." I therefore submit that the fern should be known as *Nephrodium gongylodus* (Schkuhr).—W. W. WATTS.

WEST GLOUCESTERSHIRE (v.c. 34) RECORDS. Miss Todd, of Aldbourne, Wilts, informs me that she has found *Polypodium Dryopteris* and *Jasione* near St. Briavels; this is a first record of the latter for v.c. 34, although it occurs just over the Wye in Monmouthshire and plentifully in Glamorganshire. It was recorded long ago from Painswick (v.c. 33), but I am unable to confirm either record by specimens; *Scabiosa Columbaria* is not infrequently mistaken for it. Miss Todd has also shown me excellent *Cratægus oxyacanthoides* from Hawkesbury—the first trustworthy record for v.c. 34; this is frequently recorded from E. Gloster—and also a beautiful sheet of Limosella from a pond in the Forest of Dean; this confirms Winch's record in Baxter's *British Flowering Plants* (iii. 212).—H. J. RIDDELSDELL.

CREPIS VIRENS AND C. TECTORUM. Mr. E. B. Babcock, of the University of California, writes: "The genus *Crepis* is coming into prominence because of its unusual promise as a subject for genetical research. We have been working at *C. virens* and *C. tectorum* for about three years, and find ourselves in need of more of the many forms found among them, and we should be grateful for any material that might be sent us. In addition to the variations between these species, I wish to secure achenes of all other species of *Crepis*. We find this to be necessary because we have already met difficulty in producing viable hybrids between *virens* and *tectorum*." Mr. Babcock's address is:—College of Agriculture, Berkeley, California.

REVIEWS.

Svensk Fanerogamflora af C. A. M. LINDMAN. Pp. 639, 300 illustrations. Stockholm. Price 14½ kroner (16*s*.).

THIS latest Swedish Flora—which, though dated August 1918, only came to hand towards the end of last year—is the size of Hartman's *Skandinaviens Flora*, and follows Engler's arrangement; it is profusely illustrated with some 3000 small (but in most cases excellent) figures consisting of the parts most adapted to show the differences. The value taken of the species is a moderate one in most cases, the exceptions being 99 species of *Taraxacum* (74 named by Dahlstedt) and 205 of *Rosa*.

The history of the Swedish Flora from 1875, when Berlin published at Stockholm a very useful table showing the distribution from Scania up to Swedish Lapland and North and South Norway is a curious record of species making and unmaking. Berlin's list had 1 *Taraxacum*, 22 *Rubi*, 19 Roses, and 108 *Hieracia*: in 1891 the Lund and Upsala Societies issued a list with 5 *Taraxacum*, 163 *Rubi*, 99 Roses, and 570 *Hieracia*: in 1907 the Lund Society's list had 550 Roses, 225 *Rubi*, and 2000 *Hieracia*. In 1917 a second edition of this had 227 *Taraxacum* and 71 hybrid *Salices*. Neuman's *Sveriges Flora* (1904) had 16 Roses, 41 *Rubi*, 7 *Taraxacum*, and 96 *Hieracia*.

Taking the present Flora in its sequence, the Potamogetons by Hagström naturally follow his work of 1918; for Sweden he gives 22 species with 18 hybrids—if this genus were taken up on the lines of *Taraxacum* we should produce a good array of so-called species! There is certainly one element. The clean condition of the specimens of the aquatic plants of the Swedish Flora is remarkable; with the most careful treatment of our specimens it is hard to produce anything like the specimens issued in Tiselius's Swedish exsiccata of the genus and the beautiful series I possess other than those from Dr. Tiselius; I suppose this results from the purity of the water and the comparative absence of Algæ. The Gramineæ show a near approach to our Flora so far as regards the value placed on species; as an example—*Poa Balfourii* Parn. is placed as a subsp. of *P. glauca* Vahl. and an estimate of *P. glauca* may be found by the synonymy (*P. cæsia* Sm., *P. glauca* Sm., *P. aspera* Gaud., *P. Parnellii* Bab. p.p.); under *Festuca* are *Vulpia* and *Scleropoa*: *Zerna* Panzer is used for the *Schenodorus* Fr. part of *Bromus*. *Calamagrostis* is retained, *C. strigosa* (Wahl.) being *epigejos* × *neglecta*—an identification which I have contested in Trans. Bot. Soc. Edinb. xxvii. 307 (1919). *Koeleria* has only *glauca* and *gracilis*. There are 90 species of *Carex*; the illustrations here are very good. The author wisely has *C. salina* Wahl. with one subspecies, and the remark that the Swedish form is "var. *kattegatensis* (Fr.) Almq."; he uses *diversicolor* Crantz (1776) for *flacca* (1771) and *glauca* (1772). Under *C. Œderi* he has *C. pulchella* Lonnr. (subsp.), this is a small form of *Œderi* and is British; as a subspecies. He questions whether *C. filiformis* L. = *C. lasiocarpa* Ehrh., and uses *C. Hudsonii*, doubting whether *C. elata* All. is the same. The list is very British, except of course for the species we do not possess. He divides *Juncus alpinus* into 4 species, giving figures of the fruits.

Of the trees Lindman figures leaves, or half leaves, with their venation; this seems to be too definite, as leaves on one tree will vary to any extent; he figures six forms of *Populus* and I think he who tries to name by these will fail. Under *Salix* 24 species are given and about 110 hybrids; in *Betula* the fruits as well as the leaves are figured. In *Rumex* he places *agrestis* Fr., *obtusifolius* Wallr., *divaricatus* Fr. and *silvestris* Wallr. under *R. obtusifolius* L. In *Polygonum P. tomentosum* Schr. (emend. Kern.) = *P. lapathifolium* Ait.; *P. lapathifolium* L. is doubtfully referred to *P. nodosum* Pers.; *P. heterophyllum* Lindman is established for *P. aviculare* L. p.p., and under this there are five other names; the Scandinavian form of *P. Raii* Bab. is *P. acadiense* Fernald. Under *Atriplex* Edmonston's *A. glabriusculum* supersedes *A. Babingtonii* Woods. *A. hastata* L., Wg. includes *A. calotheca* Fr., and *A. hastifolium* Salisb. = our *hastata*: there is a new species—*A. præcox* Hülphers.

In Caryophyllaceæ Lindman has *Cerastium subtetrandrum* Murb. —a useful name for specimens it has been difficult to associate with *tetrandrum* on account of the length and direction of the capsules. *Alsine rubella* is kept up; *Arenaria norvegica* Gunn (1772) is named *A. ciliata* L. var. *humifusa* (Wg.) Hartm.; *A. gothica* is retained as a species. To the ordinary British botanist it seems odd to see *Ceratophyllum* placed between *Nuphar* and *Ranunculaceæ*. Under *Ranunculus* the outlined leaves might easily lead astray; the Batrachian *Ranunculi* are under 7 species, *divaricatus* Schr. being used for *circinatus* Sibth. In *Cruciferæ*, *Cochlearia* has only 3 species—our common ones; *Radicula* is used for *Nasturtium*; *Draba* (12 species) is monographed by Elisabeth Ekman. *Saxifraga* has 15 species; *S. cæspitosa* L. is referred to *S. grœnlandica* L.; this is perhaps strictly right, but the British *grœnlandica* of Ben Lawers and Cwm Idwal is very different from the true *cæspitosa* of the Arctic regions and Ben Avon. In *Cratægus* we have 6 species, two of them new—*C. curvisepala* and *C. Palmstruchii*. In *Rubus* leaves are shown in black on a grey ground; it is impossible to see what useful purpose these can solve: let any one take a Bramble from May to Sept. and match the various leaves and compare the result with the figures on p. 309. Of the 40 *Rubi* only one bears the name of a British author. In *Alchemilla* we have 15 species with two pages of figures of leaves: in *Rosa* 4 pages, with a table extending over six pages showing the relations of the Swedish plants. In *Trifolium*, of the 13 species there only two are not British. *Callitriche* has 5 species, *stagnalis* being retained; *Viola* has 20 species, *rupestris* being used for *arenaria*; in the *tricolor* series are only two species. *Epilobium* has 17 species, *adnatum* being used for *tetragonum*. *Oxycoccus quadripetalus* Gilib.—a name which can hardly stand—is used for *Vaccinium Oxycoccus* L. *Primula scotica* Hook. is retained as a full species. In *Statice* there are only two species—*S. humilis* C. E. Salmon and *S. rariflora* Drej. In *Veronica*, *spicata* is given (not *hybrida*), and judging from the leaf figured it is correctly named. *Euphrasia* has 9 species; *Rhinanthus* has *R. minor* Ehrh. subsp. *stenophyllus* Schur. and *R. grœnlandicus* Chab. In *Valeriana*, *V. baltica* Pleijel = *simplicifolia* Led.

In *Compositæ* we have *Carduus* and *Cirsium* Hill, and 9 hybrids. *Taraxacum* has a key of 13 pages to the 99 species. *Hieracium* (by Dahlstedt) has 89 species, but grouped under some names are other forms; *e. g.* 12 under *cæsium* Fr. One would have expected that in Sweden there would have been many of the 52 forms described by Norrlin in Herb. Mus. Fennici (1889) pp. 146–153, but only three are given for both. Surely the climatal conditions in Finland, especially south of 68° N. lat., must be similar in the adjoining part of Sweden? and does not this go far to show these are local forms induced by local conditions? Again, out of 168 species of *Hieracia* named as occurring in Finland, 46 are found in one province each only, ranging in latitude from 60° to 69°.

With regard to the statistics of the Scandinavian Flora my friend Dr. Nordstedt of Lund tells me that the only work which approaches Berlin's in usefulness is *Enumeratio Plantæ Sueciæ, Norvegiæ, Fenniæ et Daniæ* by H. Hamberg, published at Stockholm in 1897.

Keys to all genera with more than three species as well as to the species themselves, combined with clear printing and general arrangement make Dr. Lindman's book a desirable acquisition; but one has a lingering regret that the style of Hartmann's *Flora* was not adopted.

ARTHUR BENNETT.

American Honey Plants together with those which are of special value to the Beekeeper as sources of Pollen. By FRANK C. PELLETT. 8vo, cloth, pp. 297, 155 illustrations. American Bee Journal, Hamilton, Illinois. Price $2·50.

THIS, which is announced "as the first book in the English language on the subject of the Honey Plants," is the result of many years of study and personal visits to important honey-producing districts, from New England to California and from Canada to Florida and Texas. It is in every way an attractive volume, and is the work of one who is not only thoroughly conversant with his special subject of bee-keeping—as to which he is indeed a recognized authority—but with the plants from which the objects of his study derive their material.

The title gives a somewhat inadequate notion of the contents of the book. The plants of course form its leading feature, and there are special articles devoted to the "honey-flora" of the principal States, in which the more prominent constituents are enumerated, with notes as to the times of flowering, the predominance and succession of particular species and their relative importance. The species are not described, being for the most part familiar and of common occurrence, but excellent figures are given of more than 150. The subject of nectar, its physiology and secretion, is treated in two long articles, in the course of which the researches of Sprengel (the title-page of whose book is reproduced), Darwin, Delpino, and Müller are admirably summarised by Professor Trelease. The contents are all arranged under one alphabet; the plants are entered under the names by which they are most widely known, the Latin and other names appearing as cross-references. In the larger genera, such as *Solidago*, *Aster*, and *Salvia*, the chief honey-yielding species are discriminated; the question as to whether the honeybee is able to secure honey from

Trifolium pratense is discussed at some length and decided in the affirmative.

In addition to his own observations, Mr. Pellett has availed himself of those of "a multitude of beekeepers" whose help he gratefully acknowledges. Sometimes curious items of information are given, such as the account of the introduction of the honeybee into Alaska in 1809 by a monk named Cherepenin: "These bees came from the Department of Kazan, in Siberia, and were brought that honey might be added to the scanty food supply of the pioneer-teachers of the Faith as well as to supply the candles for the church services. By decree of [the] Church, only wax candles can be used, and it is recorded that at Sitka in 1816 no services could be held for six months because the supply of wax ran out. . . . It should be observed that a majority of [the honey-yielding] plants have pendulous flowers. In a climate such as at Sitka, where the normal precipitation is 120 inches, only pendulous flowers could protect the nectar."

As we have already said, the book is attractively produced; the typography is excellent and the convenience of the reader is considered by the addition of an excellent index. Our own bee-keepers will find in it much of interest: we note the inclusion of species not, we think, usually regarded as bee-plants, such as *Arctium* and *Polygonum Convolvulus*, and notably of "Fireweed" (*Epilobium angustifolium*)—so called because "it springs up following forest fires and covers the burnt district with a dense growth"—which is important as a source of honey—very light in colour and of high quality—in much of eastern Canada and in many of the States.

Forests, Woods, and Trees in relation to Hygiene. By AUGUSTINE HENRY, M.A., F.L.S., M.R.I.A., Professor of Forestry, Royal College of Science, Dublin. Constable & Co. Ltd., 1919, pp. xii, 314, with 50 illustrations. Price 18*s*. net.

THE recent abnormal felling of our timber has brought home to us the often-urged importance of afforestation. This has been forcibly maintained from the point of view of the inevitable future national need of timber by Mr. E. P. Stebbing in writings previously noticed in this Journal. Dr. Henry treats the subject from a different standpoint, that of national health, the present work being an expansion of three lectures given by him at the Society of Arts in May 1917, under the Chadwick Memorial Trust. His main sanitational topics are the question of the proximity of trees to sanatoria, the value of parks, open spaces, and trees in towns, and the species best suited for such planting; the hygienic importance of the afforestation of pit-mounds in mining districts; and the great importance of the afforestation of our public water-catchment areas. This last topic occupies more than four-fifths of the volume, all the large urban water-catchment areas in the United Kingdom being described *seriatim* with maps and plans, and one chapter devoted to a discussion of the most suitable species of trees for the purpose. These chapters constantly exhibit Dr. Henry's well-known knowledge of the ecology and cultural characteristics of the native and introduced trees of our islands, and should be carefully studied by every British or Irish arboriculturist. The third chapter exhibits in a striking manner the vacillating, unscientific empiricism of modern medicine; while in sharp contrast to its methods—or want of method—the preceding pages contain a brief but thoroughly scientific analysis of the varied influences of forests upon the atmospheric conditions that make up climate. It must be borne in mind that Dr. Henry is concerned only with temperate latitudes and mainly with "insular" conditions; but we certainly expected to have found a greater recognition of the presumably different effects of masses of xerophytic conifers with limited transpiration on the one hand and of broad-leaved mesophytes on the other.

Each chapter is furnished with a valuable set of references, and there is an adequate index. We hope that the book will attain the object stated in the Preface—that of interesting "the statesman, the student of economics, the engineer, the physician, and the layman, as well as the forester."

G. S. Boulger.

BOOK-NOTES, NEWS, etc.

Those interested in the practical aspects of plant pathology will regret the death of John Snell, who died at Preston on April 19th, in his forty-second year. Snell was at one time a schoolmaster, and having taken his London B.Sc. became demonstrator and lecturer in Botany at Birkbeck College. He was a very capable manipulator and, in 1912, took up the post of demonstrator in Histology at the Middlesex Hospital. The following year he was appointed one of the district inspectors of the Horticultural Branch of the Board of Agriculture; his name came prominently before the public in connection with the Ormskirk Potato Trials, where he tested varieties of potatoes with regard to their resistance to wart disease (*Chrysophlyctis endobiotica*). Born of a Cornish farming-stock, Snell's interest when he got into the field was all on the practical side. The Lancashire farmers valued him at his true worth, and showed their appreciation in a very marked manner at the annual Ormskirk meetings.—J. R.

Albert John Chalmers, M.D. (b. London 1870), died at Calcutta on April 5th, while on his way home from Egypt on retiring from his post as director of the Wellcome Research Laboratories at Khartoum. He was a leading authority on tropical diseases, and the *Manual of Tropical Medicine* written by him in collaboration with A. Castellani is known to every student. After qualifying at Victoria (Liverpool) University he joined the West African Medical Service in 1897, serving later in the Ashanti Field Force. In 1901 he was appointed Registrar of the Ceylon Medical College, but resigned his position in order to devote more time to the study of tropical diseases; in 1913 he was appointed to Khartoum. The study of disease-causing fungi was of peculiar interest to Chalmers: he published several papers on various aspects of the subject, and was hoping to apply the latest developments of systematic mycology to the study of some of these intricate organisms.—J. R.

Hawaii Nei 128 Years Ago is the title given by Mr. W. F. Wilson, of Honolulu—its editor,—to the portion of the Journal of Archibald Menzies (1754–1842), kept during Vancouver's Voyage on the 'Discovery,' which relates to his three visits to the Sandwich Islands (1792–4). The Journal itself is in the Library of the British Museum (Addl. MS. 32641), and, although the account of the ascent of Hualalai, which forms its most interesting portion, has been published more than once, the full account of the three visits is now printed for the first time. This contains many interesting observations in regard to the leading Hawaiian kings and chiefs, and about the primitive manners and customs of the natives, which we agree with Mr. Wilson in thinking well worthy of publication. The editor has done his work exceedingly well. He has prefixed to the Journal an excellent biography of Menzies, with a reproduction of the crayon portrait by Eddis preserved at Kew; there are a number of illustrations of the vegetation and of topographical features, taken from original photographs, with reproductions of portraits from old engravings, including one of Kamehameha, King of Hawaii, taken in 1817: cross-headings and useful footnotes have been added, and there is an excellent index: the diary itself makes interesting reading. We find no indication of price or of publisher's name, but copies can doubtless be obtained from Mr. Wilson.

More than sixty years ago, the Religious Tract Society published a little shilling book by Anne Pratt (who died in 1893 at the age of 87) entitled *Wild Flowers of the Year*; and the same Society has now once more reissued the work in more ambitious guise as a six shilling volume. It is no small testimony to the accuracy of the author, to whom so many have in their early days been indebted, that it should be possible to issue the little book practically unchanged; the style, with its frequent references to religion, seems curiously out of harmony with the present-day attitude, but the botanical portion is as useful now as it was when it first appeared. The present edition is illustrated by numerous coloured plates of German origin, which have we think done duty at least once before in a similar capacity; these include plants that are neither British nor referred to in the text, and were "selected, described in an appendix, and indexed by the Rev. Professor George Henslow."

Messrs. Holden and Hardingham send us *Everybody's Book of Garden Annuals* (1*s.* n.), by Mr. Hazlehurst Greaves, F.L.S., which they have recently published. It contains cultural directions and an alphabetical list of the plants recommended with descriptive notes on the more attractive varieties—we doubt whether the Cornflower known as "Emperor William" is likely to be "much sought after" at present! Many of the names are misspelt or have misplaced capitals; the "illustrations by the author" are about the worst we have ever seen, and disfigure rather than embellish the little book.

The fifth part of the *Journal of the Botanical Society of South Africa* (1919, but only just to hand) contains a paper on "Our Aloes" by Dr. I. B. Pole-Evans and "Notes on Kirstenbosch *Leguminosæ*," in which, short as it is, three ladies have coöperated. The Journal, which is edited by Mr. R. H. Compton, Director of the

National Botanic Gardens at Kirstenbosch, is in large quarto—an inconvenient size—and the number of each page appears in black letters at its foot—thus, "**Page One**": the ingenuity of the human mind in inventing useless innovations is inexhaustible, as is also its inability to make use of patent opportunities. Of this latter *Science Progress*, which provides a valuable quarterly review of scientific thought, work, and affairs, affords a conspicuous example: in no case has the page-heading any relation to the paper over which it stands. In the April issue Dr. Salisbury and Dr. Kidd summarise the "Recent Advances in Science" for Botany and Plant Physiology, which are treated as separate subjects.

The *Journal of the Linnean Society* (Botany: vol. xliv, no. 800, Mar. 18) contains two papers on Fossil Botany—"*Bennettites Scottii*, sp. n., a European Petrification with Foliage," by Dr. Marie Stopes (2 plates), and "On the External Morphology of the Stems of *Calamites*, with a Revision of the British Species of *Calamophloios* and *Dictyo-Calamites*," by the late E. Newell Arber and F. W. Lawfield (3 plates). Messrs. Paulson and Somerville Hastings contribute a paper on "The Relation between an Alga and a Lichen" (2 plates).

The *New Phytologist* for January and February (issued March 30) contains papers on "The Evolution of Plants" by Mr. Tansley, based on the memoir on *Thalassiophyta* by Dr. A. H. Church, which was noticed in this Journal for February; "Phylogenetic Considerations on the Internodal Vascular Strands of *Equisetum*," by Lady Isabel Browne; "Mutations and Evolution" by Dr. R. R. Gates; "*Campylonema lahorense*," n. sp.," by S. L. Ghose; "The Occurrence of Actinomyces-like Endotrophic Mycorhiza" by Jean Dufrenoy; "Elementary Lecturing by the help of Schedules," based on those prepared by Dr. A. H. Church; and a notice of the late Professor J. W. H. Trail.

The recently published part (vol. v. sect. ii. part iii.) of the *Flora Capensis*, issued at the somewhat odd price of 11*s*. 3*d*. contains the conclusion of the *Euphorbiaceæ*, by Mr. Hutchinson and Sir David Prain; *Ulmaceæ* by Mr. N. E. Brown; and the beginning of the *Moraceæ* by Messrs. Brown and Hutchinson.

On April 13th, before the Royal Horticultural Society, Mr. J. K. Ramsbottom read a paper on "Further Investigations on the Eel-worm Disease of Narcissus." Mr. Ramsbottom had previously demonstrated that the so-called "Fusarium" disease was due to the eel-worm *Tylenchus devastatrix* and not to the fungus *Fusarium bulbigenum*. After several years of experiment he has shown that the disease which threatened the Narcissus industry with destruction can be successfully treated on a commercial scale by soaking the bulbs in hot water at a constant temperature of 110° F. for three hours: no damage is done to the flowers if the treatment is carried out in July, August, and September.

For the convenience of those who may wish to have it separately, a few copies of Lieut.-Col. Wolley-Dod's "Revised Arrangement of British Roses" have been printed in pamphlet form and may be had from Messrs. Taylor & Francis, Red Lion Court, Fleet Street, E.C. 4, price 1*s*. 6*d*. post free.

"JOURNAL OF BOTANY" REPRINTS.

In view of the fact that the stock of these is in some cases practically exhausted, the attention of our readers is directed to the list which appears on the following page. Old subscribers of course already possess the matter contained in them in the pages of the *Journal*; but some of them appeared several years ago, and recent subscribers will thus not possess them. Some, which do not appear in the list, are already out of print; of others very few copies remain, and it will of course be impossible to reprint them: among the latter may be mentioned Mr. Riddelsdell's *Flora of Glamorganshire*, Mr. Dallman's *Notes on the Flora of Denbighshire* (1911), and Mr. Bennett's *Supplement to 'Topographical Botany.'* Of the Supplements to the *Biographical Index* no complete sets remain. It had been hoped before this to issue the second edition of the work, in which these Supplements are of course incorporated, but the present cost of paper and labour has rendered this impossible. Of the *Index* itself no copies remain, these having been lost in the course of transferring the stock to Messrs. Adlard. Mr. Garry's *Notes on the Drawings of Sowerby's 'English Botany,'* containing, as it does, much topographical information and numerous unpublished notes by Smith, Sowerby and others, should be in the possession of all interested in the history of British Botany: only sixteen copies remain.

It may be pointed out that, although for the most part relating to British Botany, certain of the reprints have a more general appeal. Such are the *Index Abecedarius*—a list of the plants in the first edition of Linnæus's *Species Plantarum*, showing at a glance what are included in that work, which has no index of species; the *History of Aiton's 'Hortus Kewensis,'* which contains much information as to the authors and contents of that classical work; the *Flora of Gibraltar*, which, besides a complete list, contains notes on the more interesting species; Linnæus's *Flora Anglica*—the first English Flora—has a bearing upon nomenclature: of all these there are numerous copies.

[*Over.*

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No. 691 JULY, 1920 Vol. LVIII

THE JOURNAL OF BOTANY

BRITISH AND FOREIGN

EDITED BY

JAMES BRITTEN, K.C.S.G., F.L.S.

LATE SENIOR ASSISTANT, DEPARTMENT OF BOTANY, BRITISH MUSEUM.

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THE JOURNAL OF BOTANY was established in 1863 by Seemann. In 1872 the editorship was assumed by Dr. Henry Trimen, who, assisted during part of the time by Mr. J. G. Baker and Mr. Spencer Moore, carried it on until the end of 1879, when he left England for Ceylon. Since then it has been in the hands of the present Editor.

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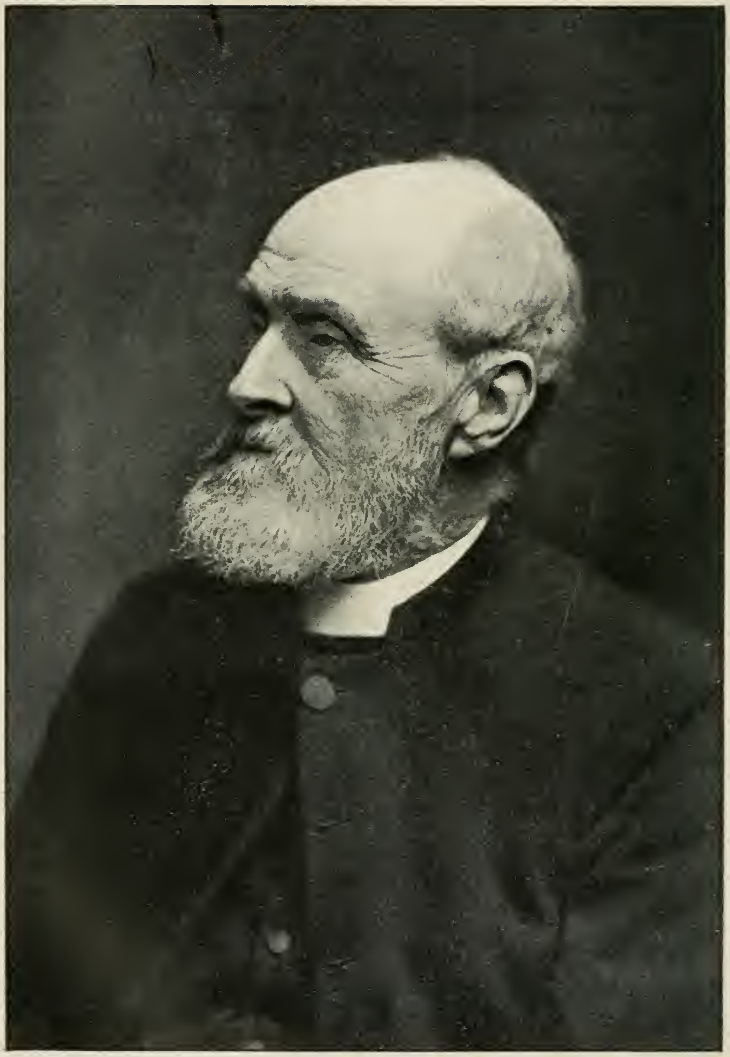


WILLIAM MOYLE ROGERS.

WILLIAM MOYLE ROGERS.

(1835–1920.)

(WITH PORTRAIT.)

"THERE is no one who knew him with any degree of intimacy who does not feel that he has lost a personal friend, and that the world is poorer by the death of Thomas Richard Archer Briggs. His humility, his single-heartedness, his great gentleness, his patient goodness, made his quiet influence a potent factor in every circle in which he moved." These opening sentences of a brief "In Memoriam" notice appeared in a Plymouth paper just after Briggs's death in January 1891, and were quoted by the late W. Moyle Rogers in the Memoir he contributed to this Journal for 1891 (p. 97). I recall them here because they describe as truly the subject of the present Memoir.

William Moyle Rogers was born at Helston, Cornwall, on July 12, 1835, and was educated at Helston Grammar School; here he was later on Assistant-Master under the late Dr. Augustus Jessopp, afterwards Head Master of the Grammar School, Norwich, and Canon of Norwich, the well-known author of *The Coming of the Friars* and many other books.

I had often wondered how it was that so able a man as Rogers undoubtedly was, had taken no degree at a University: his daughter has explained this. His father was a lawyer at Helston, and, while the son was still at school there, proposed to send him to Exeter College, Oxford; but he lost his money in a bank failure, and the University was thus out of the question. Moyle Rogers went to Dublin for a time, hoping to support himself by taking pupils, and reading for a degree in that University; but his health, never very strong, could not stand the strain of the double work. At this time he fell in with Bishop Gray, who was home on the look-out for men for his diocese of Capetown; and the Bishop secured his services, took him out to South Africa, and appointed him Vice-Principal of his college there. This Bishop it was who there admitted him to deacon's orders, and afterwards ordained him priest. While still a deacon he was placed in charge of Riversdale, as no priest was then available for the parish. Directly he was admitted to priest's orders, Rogers took charge of George Town, while the incumbent went home to be consecrated Bishop of St. Helena. During that time he resided with Bishop Welby's family at George (1860–62).

It appears that the climate did not suit Rogers very well; and in 1862 he sailed for home, and for a short time took a post with his cousin, Rev. J. S. Tyacke, then Vicar of Old Torr, afterwards Canon of Truro. Rogers was then successively Curate of Yarcombe, Devon; of Holy Trinity, W. Cowes, I. of W.; of Upton-on-Severn, Worcestershire, and of Chetnole, Dorset. To continue the list of his clerical appointments, he became Incumbent of Wolland, Dorset, in 1869; Vicar of Stapleford, Wilts, in 1872; Curate of Trusham, Devon, 1876–1882; and Vicar of Bridgerule, Devon, in 1882. In 1885 his health gave way, and he was advised to retire to the climate of Bournemouth, where he resided until his death.

During his incumbency of Woolland, Rogers married Alicia Rebecca, daughter of Major Chadwick, of Chetnole. Their son, the Rev. F. A. Rogers, inherited his father's botanical tastes, and is well known to readers of this Journal as an indefatigable collector of South African plants, many of which have from time to time been described in these pages.

It would be tedious to enumerate the papers which Rogers has contributed to this Journal: when I was asked to write some account of his work, I looked through the indexes for some thirty-eight years, and was astonished at the number of his contributions—at first on British plants generally, of late years on *Rubi* almost exclusively. A series on the flora of Devon appeared in 1877 and the three following years; from 1880 onwards several papers recorded Dorset plants. A handsome acknowledgement of Rogers's work was made by Mr. J. C. Mansel-Pleydell in the preface to the second edition of his *Flora of Dorset*:—"The frequent occurrence of his name, in almost every page, shows how much I am indebted to him for the records of new stations, and in some instances of new plants."

In 1881 Rogers was elected a Fellow of the Linnean Society. In the two following years two or three long papers on the Devon Flora flowed from his pen, recording his numerous notes. He had before this made the acquaintance of Archer Briggs—an acquaintance which soon ripened into a warm personal friendship, which he records in the long and interesting Memoir, printed in this Journal for 1901 (p. 97), as "among the choice blessings of [his] life": in 1877 "I induced him to come and spend a few days with us at Trusham, near Chudleigh, in the Teign Valley . . . . . This proved the first of a series of annual visits to my house, paid, I believe, without intermission for fourteen successive years." On several excursions, which resulted in the long paper on "The Flora of the Teign Basin, S. Devon" (1882), Briggs was Rogers's frequent companion: while at Bridgerule, the latter writes that "in brief visits in four successive years Briggs helped me to botanize the Upper Tamar Valley and neighbouring districts, as at Trusham he had helped me in the Teign Valley. In fact, in both neighbourhoods he went further afield than I was able to do; and the papers which I published in this Journal, in 1882 and 1886, on their floras would probably never have been written but for his help and encouragement." It is noticeable that, although Rogers had begun to study *Rubi* some years before, he still depended much on Briggs and Babington for naming species with which he was not familiar.

In the summers of 1889 and 1890 Rogers and I paid visits to the late E. S. Marshall, who was then Curate of Witley, Surrey; Marshall conducted each of us in search chiefly for the brambles of the neighbourhood, which resulted in "Notes on some S.W. Surrey Rubi," published in the *Journal* for 1891. The following year witnessed the appearance of a series of important articles, modestly entitled "An Essay at a Key to British Rubi," which were afterwards reissued. That Rogers appreciated the difficulty of his subject is shown by his opening remark:—"This is no more than it professes to be, an essay at a very difficult task, and I shall be content if it prepares the way for something better." These words may be taken as an intimation that Rogers had in mind a more complete work on the subject: this idea gradually took form, and resulted in the publication, in 1900, of the *Handbook of British Rubi*, which was reviewed in the *Journal* for that year (p. 401). The reviewer pointed out that it was thirty-one years since Prof. Babington brought out his *British Rubi*, and that the number of species had increased in the interval from 41 in that work to 100 in the *Handbook*: "Names had been freely imported from Germany in the past, and in some cases tacked on too hastily to English plants; and it has required years of patient investigation and toilsome correspondence with continental specialists to establish our present list on a sure foundation. In this labour Mr. Rogers has taken the principal part. . . . . Great as the work of defining the species and tracking out the synonymy must have been—a work for which a wide knowledge of the recent history of the genus was necessary,—still greater mental effort was required for the grouping of the various allied forms, and constructing the Keys and Conspectus, which introduce the fruticose section."

The late R. P. Murray owed much to Rogers for numerous contributions to his Somerset Flora, and in the preface expressed his grateful thanks. Many members of both Botanical Exchange Clubs will have reason to regret the passing away of one whose unrivalled knowledge of *Rubi* has been for so many years placed at their service.

Among Rogers's collaborators in the *Rubi* may be mentioned the Rev. Augustin Ley (1842–1911) of whom a memoir from his pen appears in this Journal for 1911, p. 201: "In *Rubus*," Rogers writes, "for the last twenty years Ley has been my indefatigable and most helpful fellow-worker," and to him Rogers dedicated his *Rubus Leyi*.

Other species of *Rubus* were described by Rogers from time to time in these pages, with a numerous array of varieties. The species include *R. lacustris*, *R. iricus*, *R. Lettii*, *R. cinerosus*, *R. Griffithianus*, *R. dasyphyllus*; *R. Marshalli* was named by Focke and Rogers in combination.

The distribution of *Rubi* in the counties of Great Britain was, of course, dealt with in the *Handbook*, and on this account was entirely omitted from Mr. Arthur Bennett's "Supplement to Topographical Botany," ed. 2, published with the *Journal* for 1905. To remedy this omission, Rogers compiled a complete list of the comital distribution, on the same lines as this Supplement; this was published in the *Journal* for 1909, and forms a very serviceable record; this he brought up to date in 1915. In 1916 (p. 37) was published a note—his last contribution—asking that specimens should be sent to Mr. Riddellsdell, whose summary of additions to the *Handbook*, compiled with Rogers's help and approval, appeared in these pages in April last.

Since he retired to Bournemouth, Rogers continually helped at the daily or Sunday services of one or other of the neighbouring churches, so far as his health allowed. A devout Churchman of the school of Canon Liddon and Dean Church, he readily found clergy near at hand who were congenial to him. While living at Pine Dene, Branksome

Park, he would help the clergy at All Saints' or St. Aldhelm's; after moving to "Chetnole," he assisted at St. Ambrose's, which was conveniently near. He had lately been failing in health rather rapidly, and passed away quietly on May 26th. There were largely attended services at St. Ambrose's at 8 A.M. and 11 on the day of the funeral, and the burial followed at the cemetery. Thus ended the long earthly career of one who was known to all his friends as a very charming and lovable man.

EDWARD FRANCIS LINTON.

A NEW MARSH ORCHIS.

BY T. AND T. A. STEPHENSON.

IT is doubtless a venturesome thing to name and describe a new species of Marsh Orchis under present conditions; but the step is not hastily taken. The plants in question have been under continuous study and observation for the last five years, during which time the whole group has been very carefully studied. The determination of the new forms can be best established by a complete discussion of the whole group. This we have worked out and hope to publish in some form or other. To botanists who have decided that *O. latifolia* in Britain is a mere jumble of hybrids, this paper will be anathema; but we ask that the question should not yet be foreclosed. It may also be said that a complete description of all the forms growing in the chief station of form A would greatly elucidate its value; but space forbids.

Orchis purpurella, n. sp.

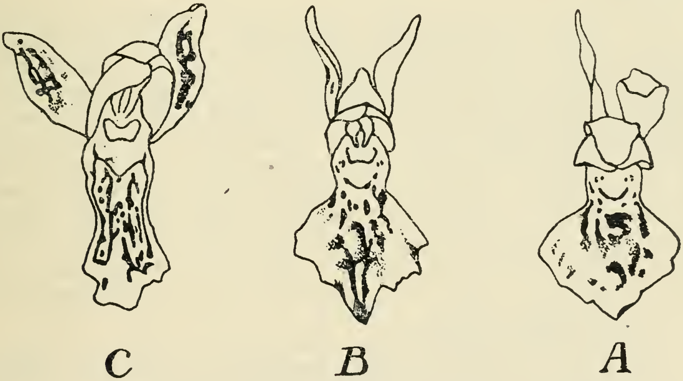
Form A. Plant short, robust, 10–15 cm. high on an average, rarely 25 cm. Spike short, about 3–5 cm. long. Mature tubers long and tapering. Stem more than half solid. Leaves keeled, lanceolate, rather broad, tapering to a blunt point, with long sheaths, the longest about 7–12 cm. long, the broadest about 1·75–3 cm. wide, with small, often very small solid spots, regularly distributed or often only at the tips of the ls., easily overlooked, never with large spots, rings, or blotches. Lower bracts purplish, scarcely exceeding fls. Flowers bright red-purple, lip flat, scarcely or not at all trilobed, of a blunt diamond-shape, slightly crenulate, somewhat thick in texture, with rather heavy markings, mostly near the centre line, edges generally incurved, at first quite sharply so, at the very edge, not at all reflexed, about 8 mm. wide and 6 mm. long. Sepals broad, erect, spur very stout, shorter than the ovary.

Form B differs from form A in having fls. of a duller purple, the lip more rounded, rather larger as a rule (10–6 mm. wide, 9–6 mm. long), with a small, cuneiform centre-lobe.

Forma A. Planta brevis, robusta (12–15 cm., rare super 25 cm.). Spica brevi (3–5 cm.). Tuberis maturis longe productis. Caule fere solido. Foliis fere carinatis, lanceolatis, plus minusve latis, in apicem obtusum contractis, vaginis longis (folia longissima c. 7–12 cm., latissima c. 1·75–3 cm.), maculis, parvis vel minimis, solidis, aut æqualiter distributis aut juxta apicem congregatis. Bracteis inferioribus vix flores excedentibus, purpurascentibus. Floribus colore claro purpureo-rubente, labello plano, integro vel obscure trilobato, forma obtuse rhomboidea, minime crenulato, textura aliquanto crassa, maculis plerumque perspicuis et juxta lineam mediam sitis, marginibus sæpissime incurvatis, præsertim juxta marginem, nunquam reflexis, long. c. 6 mm., lat. c. 0·8 mm., calcare eximie crasso, breviore quam ovarium, sepalis latis, erectis.

Forma B (a forma A) differt colore minus claro florum, labello minus integro, plus rotundato, sæpe majore (10–6 mm. lat., 9–6 mm. long.), media loba parva, cuneiforma.

It will be best to discuss first form A, about which least difficulty is likely to arise. It grows near Aberystwyth, in a very old hill-pasture, along with several other species of Orchids, which include *O. prætermissa* (Druce), *O. latifolia* L., *O. ericetorum* Linton, and *O. Fuchsii* Druce. It is a vigorous and flourishing plant of which many scores of individuals are growing with but slight range of variation amongst themselves, and very distinct from all other plants on the ground. The habit is dwarf, about 12–15 cm. being the usual height of the plant.



Sketches of enlarged flowers of *O. incarnata* and *O. purpurella* to show main features.

A. *O. purpurella*, Ambleside form.
B. *O. purpurella*, Aberystwyth form.
C. *O. incarnata*, a common rose-pink form.

Note the flatter and broader lip of *purpurella*, with less regular pattern. The rendering in black and white is necessarily very harsh and the pattern looks too marked without its coloured background.

A rather large specimen measures 16 cm. above the ground, and 20 cm. including the tubers. Tubers 4 cm., narrow, tapering into roots. Sheaths dark. Stem slightly hollow. Leaves seven in number, the two topmost narrow, bract-like, the highest just reaching the base of the spike, the longest 7·5 c.m., the widest 17 mm. They are slightly hooded and keeled, with numerous very small spots of nearly equal size. Spike 4 cm., fairly cylindrical and dense-fld. (20 flowers), lip 6 mm. long and 7 mm. wide. It is bright red-purple, with richer red-purple marks in the centre, of an irregular diamond-shape, with centre lobe scarcely distinguishable, side-lobes faintly crenulate or with slight fissures. Throat wide, pale. Sepals erect, with dark blotches inside. Spur straight, stout, slightly tapering towards the end. Bracts narrow, lowest hardly exceeding flower. There are four points to which special attention may be called: (*a*) the form of the lip, (*b*) its colour, (*c*) the spots on the ls., and (*d*) the dwarf habit.

(a) *Form of the lip.* The lip is more nearly entire than in any other allied form, of a roughly diamond-shape, more or less broad in proportion to the length. The sides are sometimes much more strongly crenulate than in average specimens, and a slight centre-lobe is found. This is more evident in dried specimens. The outline of the lip may be continuous, but for a slight nick. At any rate, the general appearance of the lip is quite distinct, as the figure will show. Reichenbach in his classification distinguishes this type of lip as "rhombeilabia," in which he includes *O. salina* Turcz. and *O. cruenta* Müll. This point is important, because our plant is very near *O. cruenta.*

The suggestion will no doubt be made that the pointed lip is due to a cross with *O. Fuchsii* or *O. ericetorum.* The nearest *O. incarnata* are miles away, and all have blunt lips. *O. Fuchsii* is in the field; but we doubt its immediate influence on *O. purpurella.* We have seen a good many undoubted hybrids of *O. Fuchsii*, and in all of them the centre-lobe is long in proportion to the whole lip, and is marked off from the side-lobes by deep clefts. Col. Godfery, who has seen the plants growing *in situ*, thinks that they may be a race proceeding from a hybrid of *O. incarnata* and *O. Fuchsii.* This is possible; but in any case we should support the view that we have here not merely a batch of primary hybrids, but a stable species. On the other hand, the origin of the forms may be due to mutation alone, or to both causes combined.

(b) *The colour of the flower* is a fine, vivid red-purple, with heavy crimson lines and blotches for the lip-pattern. It is more brilliant than any forms we have met elsewhere, though generally of the type of the lip of *O. prætermissa* v. *pulchella* Druce*, to which it might be referred were it not for the spotted leaves. It does not appear to us that this fine colour points to a hybrid origin, but rather the other way. The form could hardly be a hybrid with *O. pulchella* itself, for that form is not found in the vicinity. No doubt a strong colour may appear from the crossing of two pale forms, under certain conditions; but we see no likelihood that such a contingency is to be expected here. A great variety of hybrid forms (of pale with pale orchids and of pale with dark ones) are known, and in all cases the colour is diluted. We have not the least reason to suspect a brilliant colour latent in any form of *O. maculata.* A mutation of *O. in-*

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* The form Mr. Druce has called "Northern *Incarnata*," which (in lit. et herb.) he now considers to be *O. prætermissa* v. *pulchella.* It has considerable claims to specific rank.

carnata or *O. prætermissa* is the most likely conjecture. It may be said that a few plants of *O. prætermissa* are growing in the same field with *O. purpurella*; but no *O. incarnata*. The nearest station for the latter, of which we know, is seven miles away at least.

(c) *The leaves are normally spotted.* If it were not for this fact, the plant would be certainly set down as a dwarf form of *O. pulchella*. As it is, on the ground of these spots the influence of *O. maculata* may be suggested, and certainly will be by those who do not admit any plants with spots to be other than *O. maculata* and its hybrids. In most undoubted hybrids, however, the marks tend to be somewhat irregular patches, or, in the opinion of some, rings often very faint, but here they are always very small spots, fairly well-defined and of a uniform dark brown colour. Sometimes they are thickly scattered over the whole leaf, but often are only found near the tip, and then are easily overlooked. Sometimes they are absent. To us the facts suggest not a cross, but *a mutation in the direction of spots.*

(d) *The plants are normally dwarfs.* It may be difficult to decide in many cases when the dwarf character is merely due to impoverishment and when it is constitutional. The var. *dunensis* of *O. incarnata* is a case in point. We think in this case (*O. purpurella*) that the dwarf habit is constitutional. The plants grow in a field side by side with hundreds of tall orchids of other species. Nineteen twentieths of them will be 35 cm. high or less. A very fine hybrid of the species with *O. latifolia* (as we think) is found in two forms, both tall and short, the two forms intermixed within the same square yard of ground, and these may be Mendelian segregates with tall and dwarf characters. Here also is a case in which external conditions might favour a dwarf race. The field is an old pasture, and the plants are at their best about June 15. Two years running, when going to the field a little later than that date, we have had the sorrow of finding that a lot of young calves had been turned into the field and had cut off the heads of a great many flowers, often spoiling our observations.

Under such conditions, if Darwinian principles have any practical weight at all, we are entitled to say that a dwarf strain would have a better chance of establishing itself than a tall one. As a matter of fact, the plants of *O. purpurella* were very little interfered with.

Our belief that we have here a good species is based on the convergence of these characters, not specially on any one of them more than another. The species differs from *O. incarnata* in having spotted ls. and flat, pointed, slightly *in*curved lip, of bright purple with heavy markings, with less erect and narrow ls. It agrees with it in having rather small fls., with very wide throat and very stout spur, and broad, erect sepals.

It differs from *O. prætermissa* in having spotted ls. and pointed, incurved lip. The flower is very near indeed in colour and markings to *O. prætermissa* v. *pulchella* (Druce). Apart from the dwarf habit and spots, the leaf-scheme is one that would suit ordinary *O. prætermissa* but not v. *pulchella*, which as a rule is much more slender.

It differs from *O. latifolia* in the form of lip, the bright colour and heavy pattern, in its small size and the minute dots on the leaves. It also has the spur proportionately stouter. It differs completely from a beautiful form of *O. latifolia* growing in the same field, with which (as we think) it freely hybridizes.

The most potent objection to recording this plant as a new species is that it might turn out to be *O. cruenta* O. F. Muell. This plant is described and figured in *Flora Danica*. There is agreement, at least, in the description of the lip as "indiviso, subcordato, crenato"; but the plate (t. 876) shows copiously blotched ls. and a very short spike of dull purple fls. The colour is probably wrong. At any rate, as the late Mr. Hunnybun suggested in a letter, the term "*cruenta*" was probably given originally to a red-purple plant. The lips are much longer than wide, irregular, and with rather light markings. Here, apart from the undivided lip, all the details differ. In Reich. Icones Fl. Germ. 395, *O. cruenta* has a lip very like that in Fl. Dan. We have seen a drawing by Mr. Hunnybun of a Swiss plant which is probably *O. cruenta*, with heavily-spotted ls., lips irregular and varying much in form, with very narrow markings. One is like the Fl. Dan. lip, but others are deeply trilobed, in any case quite unlike those of our plant. The flowers were almost of a black-red. Reichenbach, as we noted above, emphasizes the character of the entire lip, but Klinge (Acta. Hort. Petrop. xvii. (1899)) puts *O. cruenta* into class CVI. of his group *Dactylorchis*, along with *O. incarnata* as the only other member of the group, and he describes the lip as trilobate or subtrilobate! We conclude, without having ever seen a Continental plant, that it would be quite precarious to identify the Aberystwyth plant as *O. cruenta*.

O. cruenta O. F. Mueller is recorded for Britain in Journ. Bot. 1899, p. 37, by Mr. Herbert Goss. He found it plentiful in two or three bogs on the fells between Borrowdale and Watendlath, and considered it stunted form of *O. latifolia*. Some specimens were sent to Mr. R. A. Rolfe, who identified it as *O. cruenta*. Since then other botanists have searched for it in vain in the same district; but Mr. Druce has gathered a plant in Durham which has been passed by Mr. Rolfe as *O. cruenta*.

At this point we may take up the question of the plant which we have assigned to *O. purpurella* as form B. In 1916 we received specimens both from Arran and from Hawkshead, Ambleside, which is not very far from Borrowdale, of which some were sent to Mr. Druce and to Kew. In both cases their identification with *O. cruenta* was favoured: see Bot. Exch. Club Report, iv. 5, p. 503. The following is taken from a letter from Kew dated Aug. 15, 1916: "It can be definitely stated that these specimens agree with the one previously recorded from Cumberland [*i. e.* Mr. Goss's specimen] also with the Scandinavian specimens, including the important lip-character, while none of them show the leaves heavily blotched with brown as in the original figure in the *Flora Danica*." Also Mr. Druce: "I think it must go to *cruenta*, although the shape of the lip is not quite identical and it is less strongly maculate. It is almost identical with the plant passed as *cruenta* by Rolfe, which I gathered in Durham."

We are therefore of the opinion that these plants all belong to one type. We have seen Mr. Goss's plant at Kew, and judge that, as far as may be determined from the dried plant, it is the same as those from Arran and Hawkshead. Now in regard to this plant all the considerations which make us doubt that *O. purpurella* form A is to be referred to *O. cruenta* apply, with this added that the form of the lip is, for the most part, obscurely but definitely trilobed.

The first gathering which we had from Hawkshead was sent by Miss Wilson on June 17, 1916. It consisted of dwarf plants, 10–15 cm. high, with few, broadly-lanceolate leaves, in some cases overtopping the spike, having the same very small spots as in the case of the Aberystwyth plant, often only at the tips of the ls. A number of plants sent from the same place on June 22, 1917, were larger, 20–25 cm. high, but otherwise precisely the same: The flowers a rich, dark purple, not the bright red-purple of the Aberystwyth plant; lip slightly trilobed—this is more evident when the plant is dry. The form varied from the rounded lip-type of *O. prætermissa* to the pointed type of form A. The leaf-pattern is of heavy crimson marks. On July 3, 1916, we received from Arran a number of plants, gathered by Mr. Allen, precisely similar to the Cumberland plants. They were growing in company with *O. maculata* and the maroon form of *O. incarnata* v. *dunensis*. In both localities hybrids with *O. maculata* occurred.

With Mr. Goss, we should have called these forms a rather dwarf variety of *O. latifolia*, had it not been that they were so evidently to be considered along with the plants already named *O. cruenta*. At the same time the short habit and rather diamond-shaped lip, and especially the peculiar type of leaf-spots, brought them into connection with the Aberystwyth form. Finally, when we had considered the difficulties in the way of ranking them as *O. cruenta*, we were driven to grouping them together under a new specific name as *O. purpurella*.

It may be added that form A is more distinct from all others of the group than form B, and we should rest our case mainly on that, if any serious objection were maintained against form B.

An average plant of form B, taken from the taller 1917 gathering, is 26·5 cm. high, tubers included. Tubers narrow, tapering, divaricate. Stem-sheaths large, dark at the tips, strongly veined. Leaves long-lanceolate, blunt, lowermost small, second (broadest) 28 mm. broad, third (longest) 1 dm. long, topmost bract-like, just short of the base of the spike. Spike 3·5 cm., globose. Bracts broad below, strongly veined, rather short. Flowers bright purple. Lip cuneate, about 8 mm. wide by 6 mm. long, crenulate below, centre-lobe blunt, small, markings heavy, of dark crimson. Sepals erect, spur of medium length, slightly tapering, moderately stout.

Hybrids of *O. purpurella*. We have so determined some very beautiful plants growing in fair numbers with form A. They appear to be crossed with a dwarf form of *O. latifolia*, which is also growing in the vicinity. A few plants which appear to be crossed with *O. ericetorum* also occur.

Of form B, both from Arran and Hawkshead, we have received plants intermediate between the type and *O. ericetorum.* Space forbids a full description and discussion of these forms.

As to the *origin of the forms*, as we have indicated already, we think they *may* have arisen from hybrid crossings of *O. incarnata* or *O. prætermissa* with some form of *O. latifolia* or *O. maculata.* At the same time we much prefer the theory that we have here two cases of mutation from *O. incarnata* (or less probably *O. prætermissa*). The whole subject is too complicated for discussion here; but we hope to go into it more fully in connexion with the general question of *O. latifolia.*

WALTER STONEHOUSE.

(1597–1655.)

By R. T. Gunther, F.L.S.

Walter Stonehouse has led a double life in history. One Mr. Stonehouse is known to Botanists as a searcher after rare plants in the northern counties and in Wales. The Rev. Walter Stonehouse is familiar to the readers of the *Register of the Fellows of Magdalen College, Oxford*, by Macray, who, while collecting many other facts about him was not aware of his botanical researches. I have recently been fortunate enough to find among manuscripts bequeathed to Magdalen College by John Goodyer in 1664 the missing links and his own anagram, which identify the Botanist with the Divine. They establish the unity of the two and show him in a new light as a considerable horticulturist for his time—one who would have gone far had not the Parliamentary Commissioners put him in prison.

The first document that drew my attention to him was an anonymous *Catalogus Plantarum Horti mei Darfeldiæ Quibus is instructus est Anno Domini*—a neatly written vellum-bound 12mo volume of 44 leaves, known as Magdalen College MS. No. 239, which is reprinted in the *Gardeners' Chronicle* for May 15, 1920, and following numbers. Its description in Cox's catalogue of manuscripts suggests that it referred to Goodyer's own garden, and its true attribution has been still further camouflaged by a printed reference to it by Dr. Druce, who (Suppl. to Bot. Exch. Club Report for 1916, p. 25) has "Cat. Plant. Horti Dalfidiæ"—a spelling which indicates that the writer had not examined the clearly written MS. when drawing up his somewhat incomplete list of Goodyer's books. Both place and time agree with Walter Stonehouse's tenure of the rectory of Darfield, to which he was instituted in 1631; but an absolutely convincing proof is afforded by the words "Theologus servus natus" written in the margin of f. 5 of the MS., the full significance of which I accidentally discovered by reading the page after sign. A4 of John Tradescant's *Musæum Tradescantianum* (1656) written by our theological botanist who is now also a poet. It reads:—

To *John Tradescant* the younger, surviving.

Anagr.:
JOHN TRADESCANT.
Cannot hide Arts.

Heire of thy Fathers goods, and his good parts,
Which both preservest, and augment'st his store,
Tracing th' ingenuous steps he trod before:
Proceed as thou begin'st, and win those hearts,
With gentle curt'sie, which admir'd his Arts,
Whilst thou conceal'st thine own, and do'st deplore
Thy want, compar'd with his, thou shew'st them
Modesty clouds not worth; but hate diverts,
And shames base envy, ARTS he CANNOT HIDE
That has them. Light through every chink is spy'd.

Nugas has ego, pessimus Poëta
Plantarum tamen, optimique amici
Nusquam pessimus aestimator, egi.

GUALTERUS STONEHOUSUS.
Theologus servus natus.

By rearranging the letters of John Tradescant's name he composed the anagram *Cannot hide Arts*, and by a similar process his own name, Gualterus Stonehousus, became *Theologus servus natus*—words quoted by Macray, who, however, did not grasp their meaning, as occurring on the titlepage of a volume of Sermons in Magdalen College Library.

By piecing together various scraps of information we find that Walter Stonehouse, born in 1597, was a Londoner—a relative of Sir William Stonehouse, Bart., of Radley, since he referred to Sir William's daughter, Mrs. Langton, wife of the President of Magdalen College, as "cousin." He came up to Oxford as one of the first Scholars of the newly founded Wadham College. There, at the age of 16, he wrote a *Turcarum Historia generalis* in 213 pages. He took his B.A. on 25th Feb. 161^{6}_{7}, and came to Magdalen as a Fellow in 1617, filling the office of Prælector in Logic in 1619–20. He remained in residence for some years, preaching occasional sermons at the University Church and in the College, including the funeral sermon at President Langton's funeral in 1626. In 1629 he took his degree as Bachelor of Divinity and resigned his fellowship, probably on marriage, since his son Walter was born in the following year. The University presented him to a rectory in the diocese of Canterbury, 7th March 163^{0}_{1}, and it may have been then that he made the acquaintance of Thomas Johnson, then engaged on the description of his second botanical tour in Kent (published 1632).

Stonehouse was presented to the rectory of Darfield by John Savile of Methley, who held him in great esteem. He became a member of the literary circle of Sir J. Jackson of Hickleton, in which Lightfoot, Sir H. Wotton, and Bishop Morton were sometimes found. With Laud he is remembered as being one of the first Englishmen to make a collection of coins and medals: these eventually formed the basis of that department of the very curious museum formed by Thoresby in his house at Leeds (see Hunter, *South Yorkshire*).

In 1639 Thomas Johnson organised an expedition of the "Socii Itinerantes" of the Pharmaceutical Society of London to the mountains of North Wales: an account of the expedition is given in his *Mercurii Botanici pars altera* (1641) reprinted in facsimile in *Opuscula omnia botanica Thomæ Johnsoni* edited by T. S. Ralph (London, 1647). The constitution of this travelling club is thus stated by Johnson in the preface to his *Iter Plantarum Investigationis* "susceptum a decem Sociis in Agrum Cantianum: Anno Dom. 1629," and published in the same year: "Paucis abbinc elapsis annis, consuetudo verò laudibilis inter rei herbariæ studiosus crevit, bis aut sæpius quotannis triduum aut quadriduum ito Plantarum investigationis ergô suscipere." Stonehouse joined the party at Chester, having spent the previous night at Stockport, where he had not been favourably impressed with the inn. Their route took them by Conway, Penmaenmawr, Bangor, and Carnarvon to Glynn-lhivona, where they were the guests of Thomas Glynn, to whom Johnson dedicated his account of the expedition. After discoursing on the perils of climbing Snowdon, Johnson gives a list of the plants found by the party. At Beaumaris they enjoyed the hospitality of Richard Buckley, visited his vivarium, and collected sea-weeds. They then recrossed the straits to Lhan-lhechid, climbed Carnedh-lhewellyn in a mist and in fear of nesting eagles, but saw little of botanical interest. After a farewell visit to Glynn-lhivona, the party journeyed to Harlech and Barmouth. Their homeward journey lay through Merionethshire; at Guerndee Stonehouse left them and went home through Shropshire to Darfield. Here he remained in quiet enjoyment of his garden, to the Catalogue of which, drawn up in 1640, reference has already been made; some of the plants in Johnson's list are included in the Catalogue, and were probably obtained on the Welsh expedition.

About 1648 we learn from Walker's *Sufferings of the Clergy* that Stonehouse was forcibly ejected from his living by the Parliamentary Commissioners and imprisoned. On his return, probably in 1652, his spirit as a horticulturist seems to have been broken, for he then wrote in the Catalogue a pathetic note in Latin, to the effect that but a few of his plants had survived—"*Novamque despero coloniam*,"—I have no hope of a new colony. After this he would appear to have lived in London, to have made or renewed acquaintance with the younger Tradescant, and to have written the introductory verses to the Catalogue of Tradescant's *Museum*, published in 1656—the year after Stonehouse's death (probably in London) at the age of 58—one verse of which we have already quoted.

Stonehouse's connection with Magdalen may have determined his friend Goodyer to leave his Botanical Library to that College, the college of Browne, and other early Botanists.

Stonehouse was personally acquainted with Parkinson, to whom he communicated his discovery at Darfield of *Viola palustris*, first recorded as British on his authority in Park. Theatr. 755 (1640). As noted by Pulteney (*Sketches*, i. 172) he travelled a good deal about England and communicated notes and localities of 36 plants, noted in his journeys or at home to How, who printed them with due acknowledgement in his *Phytologia* (1650). The notes associated with Stonehouse's name number 36, and include localities in the counties of Wilts, Berks, Oxford, Northampton, Nottingham, Derby, Chester, Lancaster, and York. Stonehouse's notes indicate both botanical observation and literary knowledge: that on "Cerasus syl. fructu minimo cordiformi non descripta" (*Prunus Avium* L.) may be cited as an example: "The least wild Heart Cherry-tree, neere Stockport, and in other places of Cheshire. The Country people there call it the Merry-tree. Whence I should thinke it the *Merasus* of the Hungarians (mentioned by Clusius Pannon, lib. cap. 24) had not hee said that hath Black Berries, whereas this hath them of a delayed red; which notwithstanding they may bee severall species."

I am indebted to Mr. Britten for this supplementary note, for the scholarly care with which he has noted the circumstances of the first excursions of the "socii itinerantes," and for other suggestions.

PLANT DERMATITIS.—II.

By E. Philip Smith
(Botanical Department, Oxford).

Cases of Lacquer Poisoning are not common in this country, but are very frequent in Japan and China where the lacquer industry is considerable. Lacquer is made from the sticky brown sap which exudes from the *Rhus vernicifera* plant when it is wounded. The dermatitis is acquired either by direct contact with the lac, or even by exposure to the fumes given off as it is evaporated. The poison, whatever it is, is much less virulent when dry than while in the process of manufacture, although cases have been recorded of susceptible persons in this country being affected while handling old lacquer-work. The symptoms are fever, tension and œdema of the skin of the face and limbs, nasal and conjunctival catarrh, and a papular eruption on the œdematous skin of the legs and forearms. As in the cases of other *Rhus* poisonings, the best treatment is with soap and water. The Chinese, however, have a quaint method of prophylaxis: "They rub the hands and face with rape-seed oil in which a ham has been boiled, and wear a linen mask for the face and a leathern apron for the body while at work. After work the exposed parts are rubbed with a decoction of chestnuts, pine-bark, saltpetre, and amaranth" (Castellani). This elaborate method does not seem to be very effective, since the workers are attacked in spite of it, and in Japan no such prophylaxis is attempted. It is in any case hardly likely to commend itself to Europeans.

In addition to those plants already mentioned as causing diseases of the skin, there are a number of industries where the handling of plant-products is known to cause dermatitis. Thus persons engaged in the confectionery trade sometimes suffer from Vanilla dermatitis. This takes the form of a rash on the hands and arms, and is believed te be caused, not by *Vanilla* itself, but by the use of Oil of Cashew to improve the colour etc. of the pods. This Cashew oil is the irritant.

Again, a considerable number of the rarer and more beautiful woods, such as are used for fine furniture, pianos, etc., and in the making of umbrella-handles and walking-sticks, or the particularly hard woods used for shuttles, are well known to have an irritating effect on the skin of the workers; and where much turning is involved, the fine dust created may affect the eyes and nose. Thus Satin-wood (both the East and West Indian varieties), produces a rash which closely resembles *Primula* poisoning. The arms and face are affected, and it is generally accompanied by head-ache. The inflammation is apt to be acute and erysipeloid: the eyes may be completely closed up, and the attack terminates by the desquamation of the affected skin. It has been demonstrated that the poisonous substance is an alkaloid, which has been called *chloroxylonine*. The following are some of the woods described as causing irritation:— Satin-wood (*Chloroxylon Swietenia*, *Backhousia citriodora*, *Xanthoxylum caribæum*); Teak (*Tectona grandis*); various Ebonies (*Diospyros Chloroxylon*, *D. Ebenum*, etc.); Rosewood (*Dalbergia latifolia*); Olive-Wood (*Elæodendron australe*, *E. orientale*); Box (*Buxus sempervirens*); Coco-wood (*Inga vera*); Partridge-wood (*Andira inermis*).

These industrial cases are important because of the questions they involve of compensation for industrial disease, and are often extremely puzzling to a practitioner who is new to the work [cf. *Report of the Departmental Commission on Compensation for Industrial Diseases*, 1907, § 887. Also, Robinson, *Annual Report of H.H.C. Inspector of Factories*, 1907].

The essential botanical interest of the subject seems to centre in the fact that the poisonous substances are apparently normal products of metabolism in the plants concerned, and that the toxic effect produced may only be noticed by accident of some economic association with the plants, by which a large number of persons are brought into contact with them or their products. This casual relationhip perhaps accounts for the seemingly irregular and sporadic occurrence of poisonous members of a genus: the reason for this being that only certain members are of economic value, and consequently handled in large quantities. It would be entering too far into debatable ground even to attempt to discuss the possible significance of these poisons in the ordinary metabolism of the plant producing them. The substances themselves are so varied, including organic acids (*e.g.* the cell-sap of the leaves of *Laportea gigas* contains ·224 °/₀ free acetic acid), alkaloids, phenols, glucosides, terpenes, etc. Their functions also are in many cases conjectural; suggestions ranging from osmotic substances or plastic materials to solvents, neutralizing agents, and the protection of the plant from attack by animals or insects.

Questions as to the secondary biological utilization of such compounds by the plant can only be answered by accurate observations on the attack and repulsion of animals or insects by the plant in question. To take a simple illustration, the "stinging hairs" of the nettle do not protect it from the attacks of swarms of caterpillars: many other so-called "means of defence" seem to be very doubtfully intentional or effective.

From the point of view of human contact with plants, the irritant materials may be divided into two classes: those substances which are soluble in water (nettle type), and those which are of an oily nature or are soluble in oily secretions (*Rhus* type). In both cases soap and water, freely applied, is the most natural and effective remedy, and one which is within the reach of all. In addition, it seems likely that *any* rough hairs or prickles may abrade a delicate skin; that almost any cell-sap may act as an irritant, and that the combined effect of the two on a susceptible person may produce a case of so-called "poisoning." This would account for the inclusion in the lists of poisonous plants of such apparently innocuous forms as *Doronicum*, *Helianthus*, *Lycopersicum*, *Myosotis*, etc. At the same time it cannot be denied that there are plants which produce results much too serious to be trifled with, and it is advisable to know and avoid them. In dealing with all such plants it cannot be too strongly insisted upon that the most important factor is personal cleanliness. This applies with all the more force to industrial cases in which compensation may be sought.

The cases described above have been selected as examples of the commoner and better-known types of Plant Dermatitis, especially those in which there is some experimental evidence of the nature of the actual irritant. A great deal of work remains to be done in that field, in isolating the toxic principles, determining their chemical composition, and examining their actual mode of action on the skin. This, however, rather leaves the domain of Botany and trenches upon that of Medicine. The poisonous principles are not necessarily characteristic of all the members of a single genus, and they are so dependent upon external conditions for their development, that the whole subject is of practical rather than of academic interest, since it is unlikely that any valuable clues to classification or evolutionary ideas will be obtained from the study of a subject in which individual idiosyncrasy plays such a large part as it does in plant dermatitis.

The following plants have been known to cause Dermatitis:—*Anacardium occidentale* (J. C. White, Boston Med. Journ. 1897); *Arctium Lappa*; *Angelica* (Brit. Journ. Dermatol. xi. p. 287); *Asparagus*; Balsam; *Catalpa bignonioides*; *Chrysanthemum* sp. (Dawson, Brit. Journ. Dermatol. 1906, p. 439); *Citrus Aurantium* var. *Bigaradia*; *Colchicum*; *Convallaria*; *Cotoneaster* (Cooper, Brit. Journ. Dermatol. xiii. 1900, p. 183); *Cucurbita*; *Cypripedium Calceolus*; *Daphne Mezereum*; *Delphinium*; *Doronicum* (Brit. Med. Journ. 1898, vol. i. p. 1244); *Eucalyptus hemiphloia* (J. Maiden, Lancet, 1904, vol. i. p. 1204); *Euphorbia*; *Ficus*; *Helianthus*; *Heracleum*; *Humea elegans* (N. Walker, Introd. to Dermatology); *Humulus Lupulus*; *Laportea gigas*; *Narcissus* spp.; *Nerium Oleander*; *Pastinaca sativa*; *Polygonum punctatum* (Lloyd, Brit. Med. Journ. 1914, vol. ii. p. 837); *Primula obconica*, *P. mollis*, *P. sinensis*; *Psoralea esculenta*; *Rhus Cotinus*, *R. Toxicodendron*, *R. vernicifera*, *R. venenata*; *Ruta graveolens*; *Scilla*; *Symplocarpus fœtidus*; *Syringa vulgaris*; *Thapsia*; *Urtica*; *Vanilla* (Oppenheim, Boston Med. Journ. 1893, vol. ii. p. 1272; Hiley, R. F., *Lancet*, 1909, vol. i. p. 1433).

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A NEW SPECIES OF COUPOUI.

By James Ladbrook

(Department of Botany, British Museum).

In this Journal for April (p. 105) Dr. Wernham gives an account of the genus *Coupoui*, which had been placed by Miers in *Apocynaceæ* but is now assigned to *Rubiaceæ*. To the three species described (*l. c.*) I now add a fourth, which I found in the Herbarium among the unnamed specimens of *Tabernæmontana*; it was, like *C. aquatica* and *C. Martiniana*, collected by Martin in Guiana. The species may be characterized as follows:

Coupoui micrantha mihi, sp. nov. Folia basi acuta, petioli flores non excedentes velut ramuli inflorescentiæ graciles, glabri: calycis limbus margine truncatus.

Branchlets straight, slender, later stout and rugose, glabrous. *Leaves* usually 4-whorled, small for the genus, glabrous on both sides, obovate-lanceolate, rounded at apex, not acuminate, gently narrowed toward the base, entire, about 20 cm. long, 6–8 cm. broad above the middle, petiole 2 cm. long, primary lateral veins 6–8 pairs. *Flowers* 10–12 in a terminal sessile umbel. Floral pedicels 1½–2 cm. long, nearly 2 mm. thick, very hairy. *Calyx* cup-shaped, 4 mm. long and 5 mm. in diameter at the mouth, hairy. *Corolla*-tube cylindrical, 15 mm. long, the cross-section 5 mm. in diameter about middle; lobes 6 spreading oblong-lanceolate, contorted, about 15 mm. long and 4 mm. broad. *Style* 15 mm. long, hairy at the base, stamens 6, anthers 10 mm. long.

SHORT NOTES.

Orchis Simia in Kent. It is interesting to record that the very rare *Orchis Simia* has again been found wild in East Kent, a spike having been received at Kew from Mrs. S. Hall, of Tunbridge Wells. It was found growing in very rough, coarse grass, in a chalky locality near Canterbury, with *Orchis Morio* and *Aceras anthropophora*, examples of which were also sent. It was in full bloom on May 15th. There are several old county records, among them Dartford, in West Kent, where it was found by William Peete [see Journ. Bot. 1916, 139]: a specimen collected by him was figured in *English Botany*, t. 1873, under the erroneous name of *O. militaris*, and another specimen from the same source is preserved in Mr. Borrer's Herbarium at Kew. Messrs. Hanbury & Marshall, Fl. Kent. p. 331, record the species as "very rare, perhaps extinct"—it is satisfactory to be able to remove the latter supposition. A painting of Mrs. Hall's plant has been made, and is at Kew. In order to prevent any misunderstanding as to the identity of the plant it may be added that *O. Simia* is easily distinguished from *O. militaris* by the narrow, very distinctly curved lobes of the lip, which are of darker purple colour. In *O. militaris* the lip is flatter, and the front pair of lobes distinctly dilated upwards.—R. A. Rolfe.

Orchis hircina L. We learn from the *Westminster Gazette* that "a Central News correspondent reports that a fine specimen of the lizard orchid (*Orchis hurcina*) (*sic*) has been found in Ashford (Kent) district. This extremely rare orchid was regarded for a long time as extinct in Great Britain, and a great stir was created by the discovery of a specimen in Kent a few years ago. Since then not more than one specimen has been found in a season, and some years have passed without any being found."

Intrusion of the Bee-Orchis. During some three years of the War, my chief lawn was let alone and allowed to run wild. In 1918 and 1919 I noticed the root-leaves appearing of several plants of some Orchid. Early this year my son, Captain E. C. Linton, R.A.M.C., was home after a period of some years' service in India, and as the job of transplanting was irksome to me, he took the trouble of collecting about thirty of the plants from the one lawn and replanting them in another lawn at one side, where I could allow them to develop, interested to see what they would turn out to be. Very slowly most of them produced a spike, and the spike has unfolded, but till the first flowers opened it was not clear what the Orchid was. At last *Ophrys apifera* Huds. stands revealed! About a dozen plants have reached the flowering stage; they vary in height from eight to ten inches, with the exception of one plant, which happens to have had two moves, and that has reached a full foot! We have long had the Bee-Orchis in the neighbourhood, but the nearest locality is about three-quarters of a mile distant.—E. F. Linton.

Lathræa Clandestina L. This plant, which was recorded in this Journal for 1908 (p. 123) as having been found near Cambridge in an apparently wild locality to which it was subsequently shown to have been introduced from the Botanic Garden, has this year been discovered in Sussex in considerable quantity, under circumstances which conveyed the impression that it formed part of the native flora. The result of inquiries establishes the fact that here too the plant, which evidently lends itself readily to naturalisation, has been introduced. In view of a recent correspondence in the *Times*, in the course of which such action was suggested, and still more in connection with the recent action of the authorities of the Cambridge Garden on which we have already animadverted (p. 30), it becomes more than ever necessary that full inquiry into the circumstances should be made before any plant, especially if of striking appearance, is recorded as British.

Sisyrinchium angustifolium Miller. On May 24 I saw *Sisyrinchium angustifolium* in flower, gathered by Mr. H. Newey in a field of vetches and lucerne to the east of Eynsford, Kent. We did not find a second example.—W. Watson.

REVIEWS.

The Flora of Chepstow. By W. A. Shoolbred, M.R.C.S., F.L.S. 8vo. cl. Pp. x, 140; map. Price 10*s.* 6*d.* net. London: Taylor & Francis.

This compact, well-printed little Flora will be extremely useful to resident botanists of Chepstow and to the many naturalists who visit the beautiful Wye Valley for the sake of its scenery and the number of interesting plants found there. The area covered by the Flora includes salt-marshes, wooded valleys, limestone hills, and peat-bog, and this no doubt accounts for the very large number of species enumerated—1013 (including Ferns etc.)—for the district; 179 species of Mosses are also recorded. By far the larger number belong to Watson's British and English types.

Among the more critical local species mentioned are: *Aconitum*, *Hutchinsia*, *Pyrus cordata*, *Pyrola secunda*, *Salvia pratensis*, *Polygonatum officinale*, *Galanthus* ("native"), *Lilium Martagon* ("undoubtedly native"), and *Carex digitata*. The district seems particularly rich in Violets, 11 species (including *epipsila*, *rupestris*, and *lactea*) and 32 varieties, forms, and hybrids being enumerated. *Saponaria officinalis* "has all the appearance of being a native on the banks of the Wye." *Stellaria apetala* and *neglecta* are given —we consider rightly—full rank as species.

Rubi records occupy eight pages, Roses but two. The group *Sorbus* is well represented—*S. latifolia*, *S. Aria*, and var. *tomentosa* G. & G., *S. rupicola* Hedl. (Syme's plant, deservedly raised to specific rank), and *S. Mougeoti* Soy-Will. subsp. *anglica* Hedl. The hybrid *S. Aria* × *torminalis* also occurs.

Amongst the Potamogetons, one is surprised to note that *P. lucens*, *P. pusillus*, and *P. densus* are wanting. *Carex Leersii* F. Schultz is superseded by *C. muricata* var. *virens* Koch, although as long ago as 1898 Kükenthal wrote "*C. virens* Koch est inextricabilis." The critical hybrid *Glyceria declinata* × *plicata* is reported.

It is not pleasant to read that "many of our rare plants, especially Orchids and Ferns, are rapidly disappearing through the thoughtlessness and greed of collectors," and that on this account "it has been deemed advisable not to state the exact spots where they can be found." We fear that some gatherers for the Exchange Clubs have been to blame for this in the past, and we trust that any ground for complaint will be avoided in the future.

We note with some surprise that Mr. Shoolbred dismisses "with little doubt" the claims to nativity on the rocks below Chepstow Castle of *Brassica oleracea*, which he considers became established there "from seed" thrown down with rubbish from the Castle garden. His knowledge of the locality entitles his opinion to respect, but the plant *in situ* conveys to the visitor the impression of a native. Mr. Shoolbred quotes the record in the *New Botanists' Guide* (1837), but the plant was observed by Banks in 1767 "growing everywhere among the rocks and in great plenty upon the walls" of the Castle (see his Journal published in Proc. Bristol Nat. Soc. ix. 17). A specimen collected by Banks on his second visit (with Lightfoot) to Chepstow in 1773 (see *Journ. Bot.* 1905, 298) is in the National Herbarium. It is curious that Mr. Shoolbred should have omitted any allusion to Lightfoot's early references, as his name is mentioned by Mr. Riddelsdell in connection with them on the page cited. It is interesting to note that, besides the *Brassica*, Banks found *Cochlearia anglica* and *Lepidium ruderale* as long ago as 1767 at Chepstow, where the latter now is only a casual. *Alopecurus bulbosus*, *Hordeum sylvaticum*, *Triticum caninum*, *Rubia peregrina*, *Sedum rupestre*, *Ophrys apifera*, *O. muscifera*, *Cephalanthera ensifolia*, *Euphorbia stricta*, and *Mentha rotundifolia* were all found at Chepstow by Banks and Solander in 1773 (see Journ. Bot. l. c.) and a *Bromus* entered as "*tectorum*" which Mr. Riddelsdell identified (l. c.) as "*B. madritensis* L. and a N.C.R."—a plant not included in Mr. Shoolbred's *Flora*.

There is a useful and interesting introduction, in which are summarised the most striking features of the flora, the geological formations, and the sources of information (which, as has been shown above, have not been exhausted), with acknowledgements of help from various botanists, including the late W. Moyle Rogers and E. S. Marshall, to the latter of whom, with his wife, the volume is dedicated. Among the books quoted is the somewhat slight *Flora of*

Monmouthshire, by Mr. S. Hamilton, published at Newport (Mon.) in 1909, which is not, we think, generally known. It might have been hoped that the author would have enriched his book by notes which he must have accumulated during his many years of field work, but this would have entailed a much larger book with its attendant difficulties.

The *Flora* is well printed, but the numbers attached to the species, if indeed they are required, should have been differentiated from those of the districts by different type. The absence of an index might have been partially atoned for had some indication been given in the page-headings of the Orders immediately beneath them; but this is not supplied.

The Geography of Plants. By M. E. Hardy, D.Sc. Oxford, Clarendon Press. Pp. i–xii, 1–327; figs. 115. *7s. 6d.* net.

This attractive-looking volume is the "more advanced book" promised in the author's *Introduction to Plant Geography*, and is, as the preface states, "in some sort an expansion of Part III." of that work. The brief account of the continents there given has formed the basis of the book before us, and has been enlarged into a full discussion of the conditions in which plants flourish, and their distribution in the great geographical divisions of the earth.

The work comprises seven chapters; the first six deal each with a continent, in this order—Asia, North America, South America, Australia, Africa, Europe—Britain coming last for treatment. A final chapter of half a dozen pages is devoted to a "Conclusion"; and the book finishes with two excellent indexes, one geographical, the other a "Plant Index."

The print and paper are excellent—a welcome change from so many books that have been produced under war-conditions. The abundant figures, many of them full-page, comprise reproductions from photographs, which, considering their size (the book is but crown octavo), are remarkable for their clearness, and sketch-maps of the various continents illustrating rainfall, mean temperature, physical features, and vegetational distribution.

The subject is treated fundamentally from a geographical point of view, as the arrangement of the chapters indicates; the book, in fact, is one of a series—"The Oxford Geographies." Stress is laid throughout upon the analogies of vegetation in the different divisions of the globe; the author is to be congratulated upon his lucid exposition of these analogies—for example the Mediterranean types, the equatorial forests of the tropical belt, and so on—and the illustrations are particularly well-chosen to aid his exposition.

In the endeavour to trace the "true homology of the plant-forms and communities" (to use the author's own words) he has not been so successful. The general problem involves the four considerations of (1) previous history; (2) process of adjustment; (3) time during which this process has been in operation; and (4) the gradual evolution of physical conditions. It would seem that the space at Dr. Hardy's disposal has proved altogether insufficient for the task that he has undertaken; and the result is that the book is difficult to read, in view of its consequently cramped style. We cannot refrain from expressing regret that he has not confined himself to the purely descriptive side of the subject, referring to his earlier volume for general considerations of soil, climate, etc. Nevertheless the book will form a valuable addition to the library of any student familiar with the general principles of plant geography, though it can scarcely be recommended to a beginner.

H. F. Wernham.

Elementary Notes on the Morphology of Fungi. By A. H. Church. Botanical Memoirs, No. 7, 1920. Pp. 29. Price 2*s*. Oxford University Press.

One of the outstanding features of recent botanical literature is the sudden outburst of publication on the part of the author of this memoir. Previously, one had associated him mainly with the backwaters of Phyllotaxy—now it is with the theory of subaerial transmigration and its slogan "The beginnings of Botany are in the sea."

The lecture notes under review are arranged as follows:—(1) Algæ (Introduction); (2) Fungi (Introduction), Heterotrophy; (3) Somatic and reproductive organization; (4) Bacteria; (5) Phycomycetes; (6, 7) Ascomycetes; (8, 9) Basidiomycetes; (10, 11) Uredineæ and Ustilagineæ; (12) Lichens; (13) Root-tubercles and Mycorhiza. Each lecture occupies two full pages. The matter is put forward in note form, but nevertheless makes stimulating reading. The usual "types" are given, but with far more information than is customary in text-books. A few statements are a little out of date—and "fungology" and "Æcidiomycetes" are objectionable.

The author's contention is that the fungi consist of large and isolated groups with no direct relation to one another or to any modern algal forms: they are saprophytic and transmigrant derivatives of marine algæ. It is always a good thing in elementary lectures to give students a clear lead. There is no ambiguity in Mr. Church's case, and a reasonable hypothesis is interwoven with the facts concerning the more commonly studied fungi. *Morchella* is regarded by the author as a typical "primitive" Ascomycete. It may be the "mere speculation" mentioned in the text, but it does seem that genera such as *Eremascus* more nearly approach ancestral forms: minuteness has nothing whatever to do with the matter from this point of view. There are whole series of fungi with differentiated sexual organs, more or less globose asci, and ill-defined peridia; these appear to make distinct ascending series from forms like *Eremascus*, where there is furthermore an absence of ascogenous hyphæ. The author's remarks on Lichens are also open to argument, but the striking fact in this short, well-printed, and cheap pamphlet is that there is so much that stimulates discussion.

J. Ramsbottom.

Roses: their History, Development and Cultivation. By the Rev. Joseph H. Pemberton, Vice-President of the National Rose Society. Longmans, Green & Co. Price 15*s.*

Most books that have been written on roses of late years have dealt with them in a more or less popular vein, ignoring anything in the shape of botany or science. This of course is natural, as those who wish to grow roses for the decoration of the garden or the greenhouse, or for display on the exhibition table, are helped very little by the study of botanical details. In the work before us, however, the author has been bold enough to deal with the botany of the Rose as a preliminary to cultivation and propagation, and its treatment for exhibition purposes. This has evidently been no drawback to the popularity of the work, which has now reached a second edition, and may therefore be said to justify Mr. Pemberton's methods. The system of classification adopted has been that of Crépin, who divided *Rosa* into sixteen different sections, according to the peculiarities of the wood, prickles, leaves, flowers, and fruits. Thus we have a great range between the Rose having one simple leaf as in *R. berberidifolia* and others which have 3, 5, 7, 9 and more leaflets. In the matter of prickles also, there is a vast difference between the almost "spineless" Banksian Rose and the "Hedgehog" or Ramanas Rose of Japan (*R. rugosa*), not only in regard to numbers, but also strength, length, and ferocity. From the various groups, the author shows the reputed parentage of the various types of the modern garden roses, and this is a matter that nearly interests the real lover of roses. Once he has fallen a victim to the "Queen of Flowers" he not only wants to grow it as well as he can, but he also desires to know how such wonderful shades of colour and delicacy of scent have been evolved. Mr. Pemberton's book will enlighten him on all these points, and by the time he has made a careful study of its 334 pages, he will feel that the knowledge was worth acquiring. Although we have emphasized the botanical side of the work, it is only fair to add that quite two-thirds of the volume is devoted to the cultivation and propagation, pruning, training, and exhibiting of the Rose.

J. Weathers.

BOOK-NOTES, NEWS, etc.

In a note in the *Royal Army Medical Corps Journal* for April Capt. M. E. MacGregor writes on "The possible Use of *Azolla filiculoides* as a Deterrent to Anopheline breeding." In a series of investigations carried out by the staff of the Entomological Laboratory at Sandwich on the association of *Anopheles* larvæ and various water plants, it was found that *Azolla filiculoides* placed in a breeding tank rapidly spread, and no ova were deposited in the tank. Apparently the female anopheline mosquito must have an open water surface on which to lay her eggs, though this does not appear to be so with other mosquitos such as *Stegomyia fasciata.* It would certainly be a very easy way of reducing the numbers of *Anopheles*, and consequently the incidence of malaria, if this method of covering the surface of the water in breeding places were of general application; but it is difficult to imagine how the necessary conditions would obtain in some of the Macedonian death-traps. It is probable that in the attack on the mosquito—an attack which will have to be made from many sides—botany will play a considerable part. In addition to such points as the above there is the question of larval food, which is mainly algal; algæ can be removed by using very weak copper sulphate solution. Furthermore, larvæ frequently suffer from fungus attack, one or more Saprolegniaceæ being concerned; such fungi are easily cultivated, *e. g.* on ant eggs.—J. R.

We note with surprise that *The Garden*, in its issue for May 1, publishes an advertisement headed "Pyrola," offering to supply "one square foot of sod, containing numbers of this beautiful and interesting native, post paid, on receipt of 4*s*." The address leaves no doubt that the reference is to the rare and beautiful sandhill form of *Pyrola rotundifolia*, which is already scarce in its localities and which is thus in danger of being exterminated. A somewhat feeble protest is made in the same journal for May 22, but it seems to us little short of scandalous that a paper so widely circulated and so deservedly popular should allow such an advertisement to appear in its columns.

The *Annals of Botany* (April) contains contributions on the Vascular System and on the Anatomy of the Cone of *Equisetum*, by Miss Kate Barratt and Lady Isabel Browne respectively; on the 'Brown-Rot' Diseases of Fruit-trees, with special reference to *Monilia cinerea*, by H. Wormald; on *Puccinia malvacearum* and the Mycoplasm Theory, by M. A. Bailey; and on Plant Succession and Plant Distribution in South Africa, by Dr. J. W. Bews: Dr. Nellie Carter continues her Studies on the Chloroplasts of Desmids. The papers are fully illustrated.

A novelty in nomenclature is presented by the name *Allwoodii*, which Messrs. Allwood Brothers, of Wivelsfield, have applied to a "new race of garden plants": "half Pink and half Carnation, they possess distinctive qualities which must appeal to all lovers of flowers, and with their delightful perfume and compact Pink-like habit of growth; they will undoubtedly find a place in every garden." The name apparently takes generic rank in horticultural circles: we read of Allwoodii Jean, Allwoodii Harold, etc.

Mr. C. E. Salmon's *New Flora of Surrey* is announced for publication to subscribers at thirty shillings net, post free, the exceptionally high price for a local flora being rendered necessary by the cost of printing and material. More than half a century has passed since the publication of Brewer's *Flora*, which in the new work will be brought up to date; it will be illustrated by photographs and will contain two maps. The book will be published by the author, Pilgrims' Way, Reigate.

The *Kew Bulletin* (No. 4) contains an elaborate discussion by Dr. Stapf of the claims of *Setaria* and *Chætochloa*, the latter of which has been proposed by Dr. Scribner for retention: the decision is in favour of the former. New Indian plants of various orders are described by Mr. Dunn, and new Orchids by Mr. Rolfe; there is also a biographical sketch of the late William James Tutcher (1867–1920), and a note on the occurrence of *Carex riparia* var. *gracilis* in Britain.

In the *Lancashire and Cheshire Naturalist* for January and February, Mr. A. A. Dallman continues the notes and observations on *Ranunculus Ficaria* which formed the subject of previous communications in 1915–17. The present paper includes observations during 1917–19, and deals chiefly with floral variation; they were mostly made in Cheshire (West Kirby and Woodchurch) by the author and in Sussex (Hailsham) by Miss E. Bray; a summary of the data obtained in the same localities for 1915–17 is added for purposes of comparison with the more recent tables. The paper shows a vast amount of careful observation and is an example of what may be done in investigating the life-history of our common British plants.

The *Journal of Ecology* for March contains the first portion of a paper by Miss L. S. Gibbs on the Phytogeography and Flora of the mountain summit plateaux of Tasmania; a paper on "Marine Ecology and the Coefficient of Association," by Mr. Ellis E. Michael, of California; and a "Draft Scheme for the representation of British Vegetation in black and white," by Dr. E. J. Salisbury.

Dr. G. A. Boulenger, who is retiring from the British Museum (Natural History), has accepted a post in the Brussels Museum, where he will be in charge of the Crépin Herbarium. As our pages have already shown, Dr. Boulenger is devoting himself to the study of Roses, in the pursuit of which he proposes to visit the Vosges and other regions.

The *New Phytologist* (March and April: published May 18) contains "A Theory of Geotropism," by Mr. James Small, a continuation of Dr. Gates's paper on "Mutations and Evolution," and a discussion of "The Significance of the Efficiency Index of Plant Growth" by various writers.

The centenary of Sir Joseph Banks (d. June 19, 1920) was celebrated at the Linnean Society on June 18, by a special meeting, at which Banks's record as a traveller, a patron of science, and a botanist was summarised by Dr. Jackson, Dr. Rendle, and Mr. Britten respectively. At the Anniversary Meeting of the Society on May 27, Dr. Daydon Jackson, the General Secretary, who on that day completed his forty years in the service of the Society, announced that the number of Fellows was reported to be 700, and that the MS. of the new Library Catalogue was practically ready for printing.

In *Rhodora* for April Dr. M. L. Fernald differentiated the American *Ammophila* from *A. arenaria*, with which it has hitherto been identified, and describes it as a new species under the name *A. breviligulata*.

A letter of congratulation from the officers past and present of the Department of Botany was addressed to Mr. Carruthers on the occasion of his recent attainment of his ninetieth birthday.

The third volume (second in appearance) of *The Cambridge British Flora* has just been published by the Cambridge University Press, and the fourth volume of the *Flora of Jamaica*. containing the orders *Leguminosæ* to *Callitrichaceæ* has been issued by the Trustees of the British Museum: both will be noticed at an early date.

"JOURNAL OF BOTANY" REPRINTS.

In view of the fact that the stock of these is in some cases practically exhausted, the attention of our readers is directed to the list which appears on the following page. Old subscribers of course already possess the matter contained in them in the pages of the *Journal*; but some of them appeared several years ago, and recent subscribers will thus not possess them. Some, which do not appear in the list, are already out of print; of others very few copies remain, and it will of course be impossible to reprint them: among the latter may be mentioned Mr. Riddelsdell's *Flora of Glamorganshire*, Mr. Dallman's *Notes on the Flora of Denbighshire* (1911), and Mr. Bennett's *Supplement to 'Topographical Botany.'* Of the Supplements to the *Biographical Index* no complete sets remain. It had been hoped before this to issue the second edition of the work, in which these Supplements are of course incorporated, but the present cost of paper and labour has rendered this impossible. Of the *Index* itself no copies remain, these having been lost in the course of transferring the stock to Messrs. Adlard. Mr. Garry's *Notes on the Drawings of Sowerby's 'English Botany,'* containing, as it does, much topographical information and numerous unpublished notes by Smith, Sowerby and others, should be in the possession of all interested in the history of British Botany: only sixteen copies remain.

It may be pointed out that, although for the most part relating to British Botany, certain of the reprints have a more general appeal. Such are the *Index Abecedarius*—a list of the plants in the first edition of Linnæus's *Species Plantarum*, showing at a glance what are included in that work, which has no index of species; the *History of Aiton's 'Hortus Kewensis,'* which contains much information as to the authors and contents of that classical work; the *Flora of Gibraltar*, which, besides a complete list, contains notes on the more interesting species; Linnæus's *Flora Anglica*—the first English Flora—has a bearing upon nomenclature: of all these there are numerous copies.

[*Over.*

THE
JOURNAL OF BOTANY
BRITISH AND FOREIGN.

EDITED BY

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THE JOURNAL OF BOTANY was established in 1863 by Seemann. In 1872 the editorship was assumed by Dr. Henry Trimen, who, assisted during part of the time by Mr. J. G. Baker and Mr. Spencer Moore, carried it on until the end of 1879, when he left England for Ceylon. Since then it has been in the hands of the present Editor.

Without professing to occupy the vast field of general Botany, the Journal has from its inception filled a position which, even now, is covered by no other periodical. It affords a ready and prompt medium for the publication of new discoveries, and appears regularly and punctually on the 1st of each month. While more especially concerned with systematic botany, observations of every kind are welcomed. Especial prominence has from the first been given to British botany, and it may safely be said that nothing of primary importance bearing upon this subject has remained unnoticed.

Bibliographical matters have also received and continue to receive considerable attention, and the history of many obscure publications has been elucidated. Every number contains reviews of new and important books written by competent critics: in this as in every other respect a strictly independent attitude has been maintained. While in no way officially connected with the Department of Botany of the British Museum, the Journal has from the first been controlled by those whose acquaintance with the National Herbarium has enabled them to utilize its pages for recording facts of interest and importance regarding the priceless botanical collections which the Museum contains.

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ON ROSA BRITANNICA Déséglise.

By G. A. Boulenger, LL.D., D.Sc., F.R.S.

The Rose to which I desire to draw attention appears to have a wide distribution in this country, but I have long been embarrassed as to the name it should bear. It seems to have appeared as *R. tomentosa* Smith, *fœtida* Bastard, 1812 (non Herrman, 1762), *Jundzilliana* Baker (non Besser), *silvestris* Woods (non Herrmann), *scabriuscula* Smith; and it would, I suppose, fall under *R. tomentosa* sub-group *Scabriusculæ* of Wolley-Dod's latest arrangement (Suppl. 1920, p. 18), but for the sepals being only exceptionally reflexed.

The name *scabriuscula* is certainly inapplicable, as the type figured by Smith has the pedicel scarcely longer than the calyx-tube. Christ's *R. scabriuscula* (in *Rosen der Schweiz*) appears to be based on a variety of *R. micrantha*, and Keller's definition in Ascherson and Graebner's *Synopsis der Mitteleurop. Flora* is clearly derived from Christ's description.

This Rose has been confounded by Woods with *R. micrantha*, a specimen so named by him (from near Godstone, 1815) being preserved in the Kew Herbarium; this explains Woods's statement (Syn. Brit. Roses, p. 209) "once or twice I have observed the turpentine odour which is generally to be perceived in the family of *R. tomentosa*." The Kew Herbarium also contains a specimen under the name of *R. canina*, labelled as having been used in the preparation of Miss Willmott's book.

The name here used was first introduced by Déséglise in 1877 (Catal. Rais. p. 304) as a substitute for Baker's *Jundzilliana*, and I propose to take it up as the only one about which there can be no question. As it is necessary to be very cautious in the application of names given by Déséglise, I wish to point out that two specimens only (from Menai Bridge, Cheshire, F. M. Webb) are preserved in his herbarium with the label *R. britannica*; the name was afterwards withdrawn, as being in the author's opinion a mere synonym of Bastard's *R. fœtida*. An earlier name may some day be found, but the application of Déséglise's *R. britannica* to the following description is certainly correct in the strictest sense.

The best way out of the difficulties which confront the student of our Roses appears to me to provide him with careful and detailed descriptions of the critical forms, based not upon fragmentary herbarium specimens, but upon living bushes both in flower and in fruit. Such a description I have endeavoured to draw up from several bushes growing in Surrey, at Oxted and Limpsfield, in hedges and thickets on the Lower Greensand. The type specimens in the Déséglise Herbarium are embraced by it.

Rosa britannica.

Strong, not densely foliated bush, 2 to 3 metres high; barren year's shoots stiff, erect; flowering branches not curved but with superposed internodes often forming angles, somewhat zigzag; the inflorescence not projecting beyond the terminal leaves of the branches bearing it, solitary, geminate, or in clusters of 3 to 7. Corolla sweet-scented, but calyx and pedicels emitting a strong odour of turpentine, which is absent or only very feebly noticeable on the leaves. I wish here to observe that the odour of the leaves and other herbaceous parts in Roses is not always in relation with the glands, as usually stated in books; I have come across bushes of *R. micrantha* the leaves of which, though very glandular, were devoid of odour, even when rubbed; whilst, on the other hand, the leaves of a *R. dumetorum* (a single bush at Hadley Wood, Middlesex) had the sweet scent of russet-apple characteristic of the Sweet-brier, and Lloyd (*Flore de l'Ouest de la France*) attributes to the eglandular or feebly glandular *R. Carionii* Déségl., an "odeur *rubiginense*, quoique faible."

Prickles straight or feebly curved, rarely falciform, varying much in size and shape, strongly and gradually dilated towards the base, 1½ to 4 times as long as broad at the base, which is strongly compressed; small near the inflorescence, large on the thicker stems, where they may be very crowded and accompanied by smaller, more slender prickles, the state of things suggesting the "heteracanth" type; few but very large on the old woody stems about 20 mm. in diameter; these prickles pale brown or orange, on young shoots sometimes red, or red at the base and greenish yellow at the end.

Leaves moderate or large (75 to 105 mm. long) on the flowering branches, sometimes very large (up to 170 mm. long) on the barren shoots. Folioles 5 or 7, rather widely set, sessile, ovate or lanceolate, more or less rounded at the base, acutely pointed at the end, 1⅗ to 2⅓ times as long as broad (26 to 40 mm. by 12 to 23, but up to 52 by 34), yellowish green to bright green above, paler but not greyish or glaucous beneath, with distant very short hairs above, closely hairy beneath; more or less numerous sessile or subsessile small red glands on the lower surface, owing to which it may appear shot with red when viewed obliquely—these glands sometimes much reduced and colourless, or even absent, on the large leaves of the barren shoots; teeth acutely pointed and compressed, each with 2 to 7 stipitated glands; 18 to 27 principal teeth on each side. Petioles tomentose, with stipitate red glands and small, curved, yellowish prickles. Stipules moderately broad, auricules pointing straight forwards, beset with red glands above and on the sides.

Flowers up to 50 mm. in diameter, petals fully spread out, bright pink when half-open and in the bud, turning to pinkish white; disc convex, 4 to 5 times the diameter of the central opening; stigmas forming a rounded head; styles smooth or with a few hairs; sepals shorter than the petals, strongly glandular on the back, woolly on the sides, with 2 or 3 denticulate and glandular pinnæ, spread out, not reverted, immediately after the fall of the petals. Pedicels very long, 2⅓ to 4 times the length of the calyx-tube, which is oblong (7 to 10 mm. by 5 to 7), the former with numerous red glands on long white soft prickles, the latter with similar glands more or less abundant. Bracts much shorter than the pedicels.

Fruit ovate, rarely spherical, up to 17 mm. in length, $\frac{1}{3}$ to $\frac{1}{2}$ the length of the pedicel, orange-red, smooth or with scattered glandular prickles, usually crowned almost up to maturity by the sepals, which are usually erect or obliquely divergent but sometimes reverted; disc reddish brown, the styles sometimes slightly projecting.

Flowers in June, fruit ripe end of September or early in October.

ALABASTRA DIVERSA.—PART XXXIII *.

By SPENCER LE M. MOORE, B.Sc., F.L.S.

1. PLANTARUM MASCARENSIUM PUGILLUS.

Homaliopsis *Flacourtiacearum* genus novum.

Calyx superus, tubo campanulato lobisque 5 æstivatione imbricatis. *Petala* 5, ad marginem disci inserta, æstivatione late imbricata. *Stamina* ∞, epigyna, in phalanges 5 petalis oppositas circiter 15-andras ordinata. *Discus* ovarii tectum obtegens glandulis minutis obsitus. *Ovarium* omnino inferum, 1-loculare; ovula ∞ placentis 2 crassis approximatis loculi parte superiori affixis seriatim insidentia. *Stylus* indivisus, stigmate capitato terminatus. *Capsula* coriacea, calyce inclusa limboque persistente coronata, 1-locularis, valvis 5 dehiscens. Semina ——.—Folia alterna vel subopposita, petiolata, integra, punctis microscopicis translucentibus donata. Stipulæ (nisi fugaceæ) 0. Flores parvi, in paniculas axillares breves digesti.

Homaliopsis Forbesii, sp. unica. *Ramis* sat validis foliosis minute griseo-tomentellis deinde glabrescentibus; *foliis* oblongo-oblanceolatis obtusis nisi obtusissimis basi in petiolum gradatim desinentibus tenuiter coriaceis supra tandem fere glabris subtus minutissime griseo-tomentellis; *floribus* breviter pedicellatis in paniculas pedunculatas quam folia manifeste breviores griseo-tomentellas ordinatis; *calycis* tomentelli tubo anguste campanulato quam lobi suborbiculares longiore; *petalis* calycis lobis paullo longioribus suborbicularibus breviter lateque unguiculatis; *staminum* phalangibus petalis paullulum brevioribus, *stylo* erecto crassiusculo glandulis minutis sessilibus insperso.

Madagascar; *J. Forbes*.

Foliorum limbus 9–12 × 2–3·5 cm., in sicco griseo-viridis; costæ laterales pag. sup. prominulæ, utrinque usque 10, ascendentes, obscure arcuatæ; petioli 1–2 cm. long. Paniculæ florescentes 3–4 × 3 cm.; harum pedunculus vix 2 cm. long. Pedicelli ±1·5 mm. long. Calycis tubus 3 mm. long., ore 4 mm. lat.; lobi 1·5 mm. long. Petala 2·5 mm. long., vix totidem lat. Staminum phalanges fere 2 mm. long.; filamentorum pars connata 1·2 mm. long., ·5 mm. lat., pars libera ·75 mm. long.; antheræ ovoideæ, ·4 mm. long. *Stylus* 2 mm. long. Fructus 5 × 5·5 mm.

At first it was thought this might perhaps be proposed as another subgenus of that comprehensive genus *Homalium*, but the following

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* Types in the National Herbarium.

considerations forbid that view: firstly, the absence of a gland alternating with each staminal phalanx; secondly, the large number of stamens to the phalanx; thirdly, the wholly inferior ovary with its flat roof lined by the multiglandular disk and in consequence the epigynous petals and andrœcium; lastly, the undivided style.

In placing this plant in *Flacourtiaceæ* one cannot help feeling the incongruity of including it in the same "natural" order or family with *Cochlospermum* &c. Certainly the *Flacourtiaceæ* as understood in the "Pflanzenfamilien" make up a most heterogeneous group, and one far from an improvement on older classifications.

Vaughania, *Leguminosarum* e tribu *Galegearum* genus novum.

Calyx parvus latusque, subbilabiatus, labio antico 3-dentato postico 2-dentato. *Vexillum* inter angustiora, verisimiliter suberectum, ungue brevissimo fultum, intus nudum; alæ breviter unguiculatæ, inter se necnon a carina liberæ; carina ampla, cymbiformis, sursum incurva, apice obtusa. *Stamen* vexillare omnino liberum; filamenta filiformia; antheræ inter se similes. *Ovarium* breviter stipitatum, septis destitutum, pluriovulatum; stylus inflexus, complanatus, glaber. Legumen ——. Verisimiliter frutex ramosus. Folia e foliolum latum constantia petiolo late alato insidens. Stipulæ parvulæ. Flores in racemos axillares maxime abbreviatos bracteis arcte imbricatis primo onustos verisimiliterque ex ramis jam foliis orbis oriundos dispositi.

Vaughania dionææfolia, sp. unica. *Ramis* sat validis glabris; *foliolo* suborbiculari apice rotundatissimo ipso mucronato integro coriaceo puberulo petiolo quam foliolum longiori obovato-oblongo apice maxime rotundato ipso ope stipitis abbreviati foliolo conjuncto inferne gradatim attenuato ima basi tereti puberulo; *inflorescentiæ* axi pubescente; bracteis ovatis obtusis vel obtuse acutis dorso carinatis coriaceis vix omnino glabris; calycis pubescentis dentibus posticis quam antici latioribus; *corolla* vexillo oblongo-ovato apice rotundato margine crispulo donata alis quam carina paullo longioribus; *ovario* lineari incurvo glabro.

Madagascar; *J. Vaughan Thompson.*

Rami 3–5 mm. crass., cortice pallido cincti. Foliolum 1·5–1·7 × 1·6–2 cm.; costa media pag. sup. impressa, pag. inf. optime prominens; costæ laterales utrinque 8–10, teneræ; petiolus 3–3·3 cm. long., apicem versus 1–1·5 cm. lat., uti fôliolum in sicco supra brunneo-subtus griseo-viridis; hujus continuatio gracilis 1 mm. long. Alabastra, floribus nondum adspectis, 5–6 × 2·5–3 mm. Inflorescentiæ axis usque ad 1 cm. long. Pedicelli plerique 1–3 mm. long., pubescentes. Bracteæ 3 × 2·5 mm. Vexillum 10 × 6·5 mm.; alæ spathulato-oblongæ, margine crispulæ, 10 mm. long.; carina 8 mm. long., superne 4 mm. lat. Filamentorum pars libera 3–4 mm. long.; antheræ oblongæ, ·45 mm. long. Ovarii stipes circa 1 mm. long.; ovarium 5 × ·5–·75 mm.; stylus 6·5 mm. long. Ovula circiter 12.

This is a curious plant of which no description seems to have been hitherto published. The genus would appear to be a member of the subtribe *Tephrosieæ* and to come near *Millettia*, from which it differs in the peculiar foliage, the inflorescence, and the relatively narrow vexillum among other characters. The foliage suggests *Desmodium*

§ *Pteroloma* or *Droogmansia*; but the non-septate pod nullifies the suggestion.

Noronhea comorensis, sp. nov. Planta glabra, *ramulis* sat tenuibus ad nodos tumidis cortice pallido circumdatis paucifoliosis; *foliis* oblongo- vel ovato-lanceolatis caudato-acuminatis apice obtusis basin versus in petiolum brevem attenuatis tenuiter coriaceis nitidis; *floribus* in axillis paucis (sæpe solummodo 2) pedicellis petiolos excedentibus basi breviter bracteatis insidentibus; *calycis* segmentis tubo æquilongis deltoideis acutis margine microspice ciliolatis; *corollæ* alte partitæ ambitu subcircularis lobis ovato-oblongis obtusis in sicco nigris tenuiter crassiusculis; *antheris* sessilibus ovoideis; ovario compresso in stylum æquilongum desinente; *drupa* ovoideo-oblonga sub apice compressa acuta.

Comoro Islands; *Humblot*, 376.

Folia pleraque 6–7 × 2·5–3·5 cm.; horum cauda terminalis circa 8–10 mm. long., basi 3 mm., apice 1·5 mm. lat.; costæ laterales tenues, utrinque 6–7, pag. utravis mediocriter visibiles; petioli inferne dilatati lignosique, circa 5 mm. long. Pedicelli 10 mm. long. Calycis tubus 1 mm., lobi 1 mm. long. Corolla 6 × 6·5 mm.; lobi circa 2 mm. lat. Antheræ 2 mm. long. Ovarium 1·25 mm. long. Drupa 15 × 7 mm.

As the description shows (Bull. Mus. Hist. Nat. Paris, xiii. 550), this is near *N. Boivini* Dub., which has somewhat larger only slightly acuminate leaves of thicker consistence with scarcely visible nerves, shorter pedicels, and anthers only half the size; the ovary also is much smaller, and this points to a difference in the fruit. Beyond noting that the corolla is about as large, one can say nothing, inasmuch as M. Dubard describes it as shortly lobed, a mistake easily made seeing how the fleshy induplicate-valvate segments remain, at least in the dry state, apparently united except for their tips.

Lasiosiphon hibbertioides, sp. nov.; *ramis* rigidis cortice fusco-cinereo obductis ramulos breves copiose foliaceos pubescentes emittentibus; *foliis* sessilibus oblongis obtusis basin versus gradatim angustatis firme membranaceis utrobique sed præsertim pag. inf. pubescentibus; *capitulis* subsessilibus plurifloris pedunculo valido pubescente apice villoso insidentibus; *involucri* phyllis paucis lanceolatis acutis quam folia brevioribus extus pubescentibus intus glabris; *calycis* tubo anguste cylindrico infra articulamentum albo-villoso supra dense sericeo lobis oblongis obtusis dorso sericeis; *squamis* 5 petaloideis late obovatis calycis lobis circiter æquilongis; *antheris* inclusis anguste linearibus; *ovario* anguste oblongo-ovoideo glabro; *stylo* filiformi basi geniculato glabro.

Madagascar; *Vaughan Thompson & Forbes*.

Ramuli cicatricibus prominentibus foliorum delapsorum crebro ornati. Folia 1·5–2 cm. long., 3–4 mm. lat., in sicco brunnea. Pedunculi 3 mm. long. Involucri phylla circa 10 mm. long. Calycis tubi pars infra articulamentum 5 mm. long. vel paullulum ultra, pars reliqua superne leviter dilatata, 17 mm. long., inferne ·6 mm. superne 1 mm. lat.; lobi 5 × 1·75 mm. Squamæ 6 × 4 mm. Antheræ sup. faucibus insertæ, 1 mm. long.; inf. medium versus tubum affixæ, 1·5 mm. long. Ovarium 2 mm. long., stylus 3 mm.

Evidently near *L. madagascariensis* Decne, which has, *inter alia*, differently shaped glabrous leaves, capitula on long peduncles, and squamæ half as long as the lobes of the calyx.

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2. ACANTHACEÆ PAPUANÆ.

The *Acanthaceæ* described below were sent for determination by Mr. C. T. White, Botanist to the Queensland Government; most of the specimens were collected by himself.

Hygrophila salicifolia Nees.
Yule Island. Nos. 732, 771.
Ruellia Forbesii S. Moore.
British New Guinea; *W. E. Armit.*
Hemigraphis reptans T. And.
Boku; *Mrs. H. P. Schlencker.*

Hemigraphis suborbicularis, sp. nov. Herba fere spithamea; *caule* erecto subsimplici piloso-pubescente mox glabrescente; *foliis* petiolatis parvis suborbicularibus raro late ovatis utrinque rotundatis margine crenulatis in pagina utraque (sed inf. densius) strigoso-puberulis; *spicis* brevibus pedunculatis paucifloris; *bracteis* foliaceis calyci circiter æquilongis lanceolato-spathulatis piloso-puberulis; *bracteolis* 0; *calycis* segmentis inter sese aliquantulum inæqualibus anguste lineari-lanceolatis acuminatis piloso-puberulis; *corollæ* tubo calycem excedente sursum gradatim amplificato lobis inter se similibus; *stylo* vix omnino glabro; *capsula* calyci æquilonga apice puberula 6-sperma.

Bismarck Archipelago, Duke of York's Island; *W. Bradtke*, 271.

Foliorum limbus firme membranaceus, in sicco griseo-viridis, raro 3 × 2 cm., plerumque 1·5–2 × 1–1·5 cm.; hujus pili strigosi pag. sup. basi bulbosi; petioli summum 2 cm. long., plerumque vero 5–7 mm., piloso-pubescentes. Spicæ circa 1 cm. long. Bracteæ usque 1 cm. long., sed juniores breviores. Calycis segmenta 8–9 mm., corolla 12 mm., antheræ 1·3 mm., stylus 4 mm., capsula 10 mm. long.

The small usually suborbicular leaves serve to distinguish this species, which is close to *H. reptans* T. And.

Hemigraphis Whitei, sp. nov. *Caule* repente gracili sparsim folioso griseo-pubescente cito puberulo; *foliis* parvulis breviter petiolatis ovatis obtusis basi subrotundatis margine subtiliter crenatis membranaceis utrobique sparsim appresse piloso-pubescentibus; *floribus* in spicas densas late oblongas foliis multo longiores digestis; *bracteis* amplis arcte imbricatis ovatis obtusis vel obtusiusculis dorso sparsim pilosis margine copiose piloso-ciliatis; *calycis* segmentis angustissime lineari-lanceolatis acutis pilosis; *corollæ* tubo calyci circiter æquilongo supra medium gradatim ampliato; *capsula* calycem æquante apice puberula 6-sperma.

Yule Island; *C. T. White*, 714.

Folia 1·5–1·8 cm. long., 1 cm. lat., in sicco (uti bracteæ) viridi-grisea; petioli circiter 2 mm. long. Spicæ pleræque 3–4 cm. long., fere 1·5 cm. lat. Bracteæ intermediæ 14 × 7 mm., perpaucæ infimæ ovato-lanceolatæ, usque 18 mm. long. Calycis segmenta 6–7 mm. Corolla 10 mm., antheræ 1 mm. long. Stylus pilosiusculus, 8 mm.

long. Capsula acuta, 7 mm. long. Semina fusca, diam. 1 mm. paullulum excedentia.

The dense spikes with broad, closely imbricated bracts coupled with the very small leaves are the distinctive marks of the species.

Hemigraphis ciliata, sp. nov. *Caule* inferne repente necnon ad nodos radicante superne ascendente paucifoliato puberulo; *foliis* brevipetiolatis lanceolatis interdum acuminatis apice basique obtusis margine undulatis vel undulato-dentatis supra glabris subtus in nervis pubescentibus; *spicis* terminalibus abbreviatis breviter pedunculatis paucifloris; *bracteis* foliaceis calyce longioribus lanceolatis obtusis marginibus longe piloso-ciliatis alibi fere glabris; *bracteolis* 0; *calycis* ultra medium soluti segmentis inter se subsimilibus anguste linearibus (inferne paullo latioribus) piloso-ciliatis; *corollæ* tubo calyci circiter æquilongo basin versus angustato lobis ovatis obtusis tubo brevioribus; *capsula* calyci æquilonga apice puberula 6-sperma seminibus ovatis duobus (capsulæ unicæ scrutatæ) imminutis verisimiliter sterilibus.

Mekeo district; *White*, 796.

Folia 3·5–6 × 1–2·3 cm., in sicco griseo-viridia; petioli circa 5 mm. long. Pedunculi 2 mm. long.; spicæ 1–1·5 cm. long. Bracteæ longit. 1 cm. paullo excedentes. Calycis tubus 2 mm., segmenta 4 mm. long. Corollæ tubus 6·5 mm. long., basi 1 mm., cito usque 2 mm. dilatatus sub limbo 2·5 mm. lat.; lobi circa 2 mm. long. Capsula 7·5 mm. long. Semina majora fere 2 mm., minora modo 1 mm. long.

The species is best recognized by the strongly pilose-ciliate bracts.

Acanthus ilicifolius Linn.

Milne Bay; *Le Hunte*. The leaves of the specimen are all entire.

Acanthus volubilis Wall.

Karavara Island, Bismarck Archipelago; *W. Bradtke*, No. 349.

Pseuderanthemum confertum, sp. nov. Frutex semiorgyalis; *ramis* saltem superne bene foliatis ad nodos aliquanto tumidis pubescentibus dein glabris; *foliis* breviter petiolatis ovatis vel ovato-oblongis acuminatis apice obtusis basi in petiolum cuneatim coartatis supra glabris vel fere glabris subtus in nervis puberulis; *floribus* in paniculam spiciformem terminalem abbreviatam paucifloram pubescentem aggregatis; *bracteolis* parvulis subulatis calyce multo brevioribus; *calycis* fere usque basin divisi segmentis linearibus sursum angustatis apice acutis pubescentibus; *corolla* calyce 4-plo longiori tubo ima basi necnon ipso sub limbo leviter dilatato extus pubescente lobis tubum semiæquantibus inter se subæqualibus anguste ovato-oblongis obtusissimis; *filamentis* complanatis antheris breviter exsertis; *capsula* anguste ovoidea acuta parte seminifera stipiti circiter æquilonga.

Very common on Yule Island; *C. T. White*, No. 722.

Folia 9–12 × 3–6 cm., in sicco supra griseo-subtus pallide viridia; petioli pubescentes, 4–5 mm. long. Inflorescentia (corollis exemptis) 1–1·5 cm. long. Bracteæ foliaceæ, dorso pubescentes, ±7 mm. long. Bracteolæ 1·5–2 mm. long. Calycis tubus 1·5 mm., segmenta 3·5 mm. long. Corolla ex schedis cl. repertoris alba; tubus 22 mm. long., 1 mm. lat., ima basi ipsoque sub limbo paullulum latior; lobi 10 mm. long. Filamenta ægre 2 mm. long., antheræ totidem. Stylus 21 mm. long., inferne pilosus, superne glaber. Capsula in toto 15 mm. long.; hujus stipes 7 mm. Semina suborbicularia, minute foveolata, læte brunnea, 3 × 2 mm.

A plant of Mr. White's from the Mekeo district (No. 786) is to be referred to this. It has lanceolate leaves, mostly 9–10 × 2·5–3·5 cm., but in all other points agrees well with the type except for the seeds, which are pale in colour and somewhat larger.

So far as concerns the flowers and judging from the description, this would seem to agree in most details with *P. velutinum* Lindau; but the indumentum of this latter and its inflorescence are quite different.

Pseuderanthemum Bradtkei, sp. nov. Frutex glaber circa metralis; *foliis* petiolatis ovato-vel obovato-oblongis sub apice acuminatis apice ipso obtusis basi rotundatis cuneatisve; *floribus* breviter pedicellatis in paniculam spiciformem foliis subæquilongam plurifloram digestis; *bracteis* bracteolisque parvulis subulatis; *calycis* alte partiti segmentis lanceolatis acuminatis; *corollæ* tubo sub limbo paullo ampliato lobis tubum longit. semiæquantibus ovato-oblongis obtusissimis posticis quam antici paullo minoribus; *filamentis* complanatis antheris breviter exsertis; stylo apice bifido; *capsula* elongata glabra parte seminifera stipiti æquilonga.

Bismarck Archipelago, Duke of York's Island; *W. Bradtke*, 88.

Caulis internodia (pauca superiora solum obvia) 2–2·5 cm. long. Folia usque ad 21·5 × 10 cm., summa vero minora, *e. g.* 12 × 5 cm.; costæ laterales utrinque 9–10, pag. inf. magis aspectabiles; petioli lati, 5–15 mm. long. Inflorescentia florens 10 cm., frugiferens circa 16 cm. long. Bracteæ circiter 2 mm. long., bracteolæ vix totidem. Pedicelli 1–3 mm. long. Calyx in toto 4 mm. long.; hujus segmenta 3 mm. Corollæ tubus 20 mm. long., basi 2 mm., sub limbo 2·5 mm., parte intermedia 1·5 mm. lat.; limbi lobi postici 8 × 4 mm., antici 9 × 5 mm. Filamenta 3 mm. long.; antheræ utrinque obtusæ, 2 mm. long. Ovarium 1·75 mm., stylus 20 mm. long. Capsula 18–22 mm. long. Semina brunnea, minute foveolato-rugosa, 4 mm. diam.

The affinity is apparently with *P. pacificum* Lindau, which has much longer internodes and is therefore most probably a plant of taller habit, leaves with only 6 pairs of side nerves, much longer inflorescence and corollas with oblong lobes half as long again as those of the new species.

Pseuderanthemum Armitii, sp. nov. *Ramis* sat gracilibus ad nodos tumidis sursum foliosis minute puberulis deinde glabris decoloribusque; *foliis* pro rata parvis petiolatis lanceolatis vel ovato-lanceolatis acuminatis apice obtusis basi angustatis supra glabris subtus in nervis minutissime puberulis; *floribus* in cymulas axillares pedunculatas paucifloras quam folia breviores dispositis; *bracteis bracteolisque* linearibus uti inflorescentiarum axis calyxque minute pubescentibus; *calycis* alte partiti segmentis linearibus superne angustatis; *corollæ* tubo superne paullulum ampliato extus pubescente limbi lobis oblongo-obovatis obtusissimis posticis quam antici minoribus; *fila-*

mentis aliquanto complanatis antherarum loculis exsertis acutis; *stylo* apice bifido; *capsula* acuta minute pubescente.

Papua, Samarai; *W. E. Armit.*

Folia 5–7 × 1·5–2·5 cm.; petioli 5–10 mm. long. Pedunculi 3–10 mm., pedicelli 2–3 mm. long. Bracteæ 2–3 mm. long., bracteolæ circa 1·5 mm. Calyx in toto 6 mm., hujus lobi 5 mm. long. Corollæ tubus 24 mm. long., 1 mm. lat., sub limbo 1·5 mm.; lobi postici 10 × 5 mm., antici 12 × 6 mm. Filamenta necnon antheræ 1·5 mm. long. Ovarium 2·25 mm., stylus 24 mm. long. Semina minute tuberculata, brunnea, fere 2 mm. diam.

Affinity with *P bicolor* Radlk., but the smaller flowers on short pedicels with narrower calyx-segments and corolla with a narrower pubescent tube and smaller lobes.

Lepidagathis hyalina Nees.

Mafulu; *White*, 507.

Justicia Chalmersii Lindau ex descript.

Kwato Island, Samarai district; *E. Cowley.*

Justicia Chalmersii Lindau var. latifolia, var. nov. Folia elliptica usque ad 4·5 × fere 2 cm., sæpius vero ± 15 × 8 mm., alia minora ovata, obtusissima, circa 10 × 7–8 mm.—*Justicia hygrophiloides* Bail. non F. Muell.

Sapphire Creek; *White*, 154: Boku; *Mrs. H. P. Schlencker.*

The former of these is a very poor specimen, but should evidently be named as above: it is in fruit, the 5 mm. long. capsule being oblong, acute, and glabrous with 4 subquadrate seeds nearly 2 mm. in length. The true *J. hygrophiloides* of Queensland is a plant of more robust habit, with different leaves, flowers, and fruit.

Justicia (§ *Rhaphidospora*) **platyphylla**, sp. nov. Fruticosa; *ramis* paucistriatis glabris ad nodos tumidis super nodos constrictis; *foliis* amplis petiolatis ovatis vel ovato-lanceolatis acuminatis apice obtusis base in petiolum attenuatis tenuiter membranaceis utrobique glabris; *paniculis* laxis foliis brevioribus ex axillis summis oriundis paucifloris puberulis; *bracteis bracteolisque* parvulis filiformibus; *calycis* segmentis 5 inter se similibus linearibus acutis puberulis; *corollæ* calycem plane excedentis tubo inferne amplificato labii antici lobis late ovatis obtusissimis lobo intermedio quam laterales paullo majori; antherarum loc. inf. breviter ac tenuiter calcarato; *capsula* acuta minute pubescente 4-sperma.

Astrolabe Range; *C. T. White*, 270.

Foliorum limbus summum 17 × 7 cm., superiora minora, *e. g.* circa 12 × 5 cm., summa 6 × 2·5 cm., in sicco viridia; costæ latere utrovis 7, tenera, parum visibiles; petioli graciles, usque 5 cm. long., foliorum juvenilium multo breviores. Paniculæ 3–6 cm. long., pedunculi attenuati, 1·5–3·5 cm. long. Bracteæ bracteolæque 1–1·5 mm. long. Calycis segmenta 4·5 mm. long. Corolla alba; tubus 9 mm. long., inferne 2·5 mm. superne 2 mm. lat.; labii antici lobus intermedius 2 × 2 mm. Antherarum loculi 1·5 mm. long.; loc. inf. calcar ·2 mm. long. Capsula in toto 14 mm. long., pars seminifera 7 mm. long.; retinacula sursum angustata, 2·5 mm. long. Semina dilute brunnea, minute scrobiculata, 2 mm. diam.

Differs from *J. glabra* Kœn. entirely in foliage and corolla. In foliage it is very like the Philippine plant distributed as "*Justicia glabra* Kœn. var." (No. 15231, coll. *M. Ramos*) which can hardly be conspecific with Kœnig's plant, but the flowers of this are quite different from those of *J. platyphylla.*

This might easily be taken for a *Dianthera*, but the spur to the lower cell of the anther although small and weak is unmistakable.

White's No. 546 from Dilava, a specimen in fruit only, is evidently to be associated with this; indeed the capsule (and seeds) have been described from it.

Hulemacanthus, *Acanthacearum* e tribu *Justicearum*, gen. nov.

Calyx 5-partitus, segmentis pro ordine latis inter se æqualibus. *Corolla* æstivatione imbricata, majuscula, tubo sursum gradatim dilatato; limbus breviter 2-labiatus, labio antico 3-lobo lobo intermedio majore in æstivatione extimo labio postico integro. *Stamina* 4, infra medium tubum inserta; filamenta exserta; antheræ basi muticæ, staminum anticorum 2-loculares, staminum posticorum 1-loculares. *Pollinis* grana iis *Graptophylli* similia. *Discus* cupularis. *Stylus* filiformis, apice obtusus. *Ovula* quove in loculo 2. *Frutex* erectus, glaber. *Folia* opposita, magna. *Flores* in paniculam sat elongatam anguste thyrsoideam ample bracteatam digesti.

Hulemacanthus Whitei, sp. unica. *Foliis* petiolatis lanceolato-ellipticis apicem versus acuminatis apice obtusiusculis deorsum in continuationem late petioliformem extenuatis margine leviter undulatis papyraceis pallide nitidis; *panicula* foliis certe brevioribus axi ad nodos tumido; *bracteis* foliaceis ovatis obtusis verisimiliter mox dehiscentibus; *pedicellis* gracilibus calyce longioribus; *calycis* segmentis suborbicularibus margine ciliolatis; *corollæ* labio postico ovato-oblongo obtusissimo antici lobis ovatis obtusis lateralibus quam intermedium minoribus; *filamentis* complanatis apicem versus filiformibus antheris oblongis obtusis; *ovario* ovoideo glabro; stylo exserto.

Deva Deva; *C. T. White*, 530. The same plant was collected by *Mrs. H. P. Schlencker* at Boku, and *White's* 388 from Sogere, a very poor specimen—all but perished, in fact—evidently belongs here.

Folia 30–35 cm. long., excluso petiolo 3 cm. long., juxta medium 7–10 cm. lat.; costæ laterales utrinque circa 10, aperte arcuatæ interjectis pluribus aliis valoris minoris; rete laxum, parum perspicuum. Inflorescentia spec. unici nobis obvii 12 cm. long., 2 cm. lat.; hujus internodia inferne 3 mm., superne 6–7 mm. crass. Bracteæ juniores ±1·5 × 1 cm., summæ circa 10 × 7 mm. Pedicelli arrecti, circa 1 cm. long. Calyx 3·5 mm. long.; lobi 3 × 2·5 mm. Corolla rubro-aurantiaca, in toto circa 3 cm. long.; tubus 23 mm. long., paullo supra basin 3 mm., ipso sub limbo 7 mm. lat.; labium posticum 5 mm. long., postici lobi laterales 5·5 mm. long. Filamenta ex corolla usque 12 mm. exserta; antheræ 3 mm. long. Discus vix 1 mm. alt. Ovarium 2 mm., stylus fere 4 cm. long. Capsula haud visa.

A remarkable plant having obvious affinities with *Graptophyllum*: the broad calyx-segments, recalling those of the American genera *Bravaisia* and *Trichanthera*, and the presence of the hinder pair of (unilocular) stamens are the chief peculiarities.

Graptophyllum Gilligani S. Moore (*Justicia Gilligani* Bail.).
Astrolabe Range; *White*, 236, 353: Mekeo district, No. 791.

This is easily distinguishable from *G. pictum* Griff. by the narrow lobes of the corolla.

Calycacanthus Magnusianus K. Schum.
Bisiatuba, near Rona Falls; *White*, 360.

The corollas are not yet expanded, the largest being only a little over 2 cm. in length; but they agree with others at a similar stage of Forbes's No. 887, which undoubtedly belongs to this species.

Dicliptera Burmanni T. And.
Yule Island; *White*, 723.

This is believed to be new for Papua.

(To be continued.)

NEW MALAYAN PLANTS.

By H. N. Ridley, M.A., F.R.S.

(Continued from p. 149.)

Entada Schefferi, n. sp.

Entada scandens, Benth. in Hook. Lond. Journ. Bot. iv. 332 (1845) was based on *Mimosa scandens* L., Sp. Pl. ed. 2, 1501, which includes at least five species of the genus, all distinct—*E. Pursætha* DC. and *E. monostachya* DC. from India and Ceylon, *E. Rumphii* Scheffer from Amboina and the Philippines, and two or more species from Polynesia and South America. Bentham added some African species; De Candolle separated some of these, and Scheffer described two—one the very distinct *E. Rumphii*, the other he described (Obs. Phyt. iii. 90, t. xvi, xviii A) as *E. Pursætha*: this is not the Indian *E. Pursætha* of De Candolle, but the species which occurs in the Malay Peninsula and Java. Prain's *Entada scandens* (in Journ. As. Soc. Beng. lxvi. pt. 2, p. 242) includes *E. Pursætha* from the Andamans, and some specimens of *E. spiralis* Ridl. as well as the *E. Pursætha* Scheffer. This latter species I propose to separate under the name of *E. Schefferi*.

E. Schefferi Ridl. n. sp. *E. Pursætha* Scheffer, Obs. Phyt. iii. 90, t. xvi, xviii A, not of De Candolle. Frutex scandens ad 15 m. longus, caule ad basin 1·50 cm. crasso, ramis gracilibus pendulis glabris. *Folia* 1·50 cm. longa, petiolo ·5 mm. longo, cirrho terminali; pinnæ 4 oppositæ, 1–1·25 cm. longæ, foliolis paucis subcoriaceis atro viridibus obovatis vel oblongis obtusis vel apice rotundatis sæpe obliquis ·25–31 mm. longis 12 mm. latis, breviter petiolulatis. *Spicæ* singulæ extra-axillares 1·25–2 cm. longæ, basi 25–50 mm. nudæ, rachide puberula. *Flores* 2 mm. longi dense congesti. *Bracteæ* minutæ acuminatæ persistentes. *Calyx* cupulatus dentibus minutis. *Corolla* flava lobis oblongis obtusis, tubo calyci æquali. *Stamina* 10, duplo longiora. *Legumen* 62 dm. longum, 1 dm. latum, marginibus suturæ crassis latis dorso rotundatis obscure ad articulationes indentatis, segmentis 13, oblongis rotundatis 1·6 dm. longis, 6 mm. crassis.. *Semen* ellipticum rotundatum 37 mm. longum, 31 mm. latum, 6 mm. crassum, atrobrunneum.

Hab. In ripis fluminis Peninsulæ Malaicæ, Muar, Sungei Pauh, *Fox*; Pahang, Pekan, *Ridley*; Perak, Temengoh river (*Ridley*); Haram (*Scortechini*); Telok Anson, *Kunstler* 1018; Tringanu, Bundi, *Rostado*; Kelantan, Kota Bahru, *Ridley*; Penang, *Wallich* 5293 (*Entada monostachya*); Ayer Hitam, *Curtis*; Java, Jocjokarta, *Junghuhn*.

In the Kew Museum there is a pod very closely resembling that of this species from Pegu, collected by Capt. Mellersh, but I have no other evidence of the occurrence of the plant in Burmah. The small usually obovate round-tipped leaves, green on both sides, and the very small flowers distinguish this species readily, and the very stout round-backed rib running on each side of the pod, the segments of which are transversely wrinkled is distinctive. The only seed I have seen is smaller in most species and considerably thicker. This is the only species in the Malay Peninsula, except the very distinct *E. spiralis*, with larger leaflets, glaucous beneath, and the singular green spiral pod breaking up into joints, each of which dehisces, and exposes a larger thick light-brown seed with a thin testa. Distinct as this latter species is, Wallich distributed some leaves of *E. spiralis* with his Penang plant 5293, and Prain (*Materials for the Flora of the Malay Peninsula*) quotes two specimens of *E. spiralis* as *E. scandens*.

E. Schefferi usually occurs draping the forest on the river-banks far away from the river-mouth, but I found a large plant of it in a village in Kelantan, which supplied the village chief with soap; the bark of the plant is used for this purpose, pieces being chopped off as required. The native name of the plant is Akar Beluru, or in Kelantan, Akar Blu.

THE USE AND ABUSE OF THE GENUS.

Under this title Dr. Wilmer Stone publishes in *Science* for April 30 an article containing what appears to us a much needed protest against the practical inconvenience caused by the growing custom, more frequent in America than among ourselves, of multiplying genera on comparatively slight grounds. Dr. Stone of course recognizes the changes in nomenclature which the law of priority renders necessary: his protest is confined to "cases where a generic group is subdivided, the old name being restricted to one of the subdivisions and new names given to all the others." Such cases, he points out, are "entirely dependent upon personal opinion, with no hope of uniformity or finality. Generic groups are separated from one another by all degrees of difference, and there is no standard by which the amount of difference may be consistently measured. Consequently no two systematists will be in agreement as to how many groups may be recognized in any given family.

"Ever since the time of Linnæus generic groups have been undergoing disintegration, until in some families the ultimate condition has been reached of a generic group for every species. When this stage has been attained we have lost all trace in the scientific names of any relationship whatever between the species. The binomial name, in other words, has become useless, and we might just as well have a mononomial. The very object for which the generic name was proposed has been lost.

"To illustrate the point further, suppose that we subdivide an old genus into three, and use three generic names where previously we used but one, we emphasize, it is true, that there are differences between these three groups, but by the very same act we obliterate the fact, formerly indicated by the single generic name, that there are resemblances which join these three groups together as compared with other groups in the same family. One of these facts would seem to be of quite as much importance as the other, and by the creation of the new genera we lose quite as much as we gain. We should carefully guard against allowing our enthusiasm for the discovery of differences to blind us to the fact that the real object of systematic research is the discovery of true relationship.

"Now the whole trouble in this matter—and a vital flaw, to my mind, in our system of nomenclature—is that we try to make a double use of our system with the result that it is gradually breaking down from the impossible burden. A generic name as we use it to-day is made to serve two purposes. It is (1) a term by which we indicate to others what we are talking or writing about, and (2) a term by which the systematist indicates what he regards as a recognizable phylogenetic group. It is suicidal for any system of nomenclature that names for 'things' should be constantly changed to fit our ever changing ideas of their relationships. Surely there should be some way of indicating the progress of our studies in the relationships of birds, for instance, without rendering unintelligible to all save a few specialists, the very names by which we refer to those birds . . . . .

"The main point would be to check the excessive generic subdivision which is to-day rampant in certain quarters. If some such reform be not inaugurated, technical nomenclature will soon be—if it is not already—useless to anyone but a narrow specialist. For example, the botanist has long known of the differences between the so-called flowering dogwoods and those without involucral leaves; but what profit does he gain by changing the generic name of the former to *Conoxylon* [*sic*] compared to the loss that he inflicts upon the ornithologist, the entomologist, or the student of general scientific interests, who know them under the name *Cornus* and who, unless they be Greek scholars, have no conception of what sort of herb, shrub or tree a *Cynoxylon* may be."

Dr. Stone's suggestion is: "Why not adopt an arbitrary set of genera *de convenience* [*sic*] so far as nomenclature is concerned and use subgeneric terms when we desire to call attention to more refined phylogenetic groups. At the present time we constantly make use of 'group' names in discussing the relationships of different sets of species in a large genus without in any way interfering with the nomenclature, and the practice could just as well be extended."

We do not quite understand what is intended by "an arbitrary set of genera."

BIBLIOGRAPHICAL NOTES.

LXXIX. Lehmann's Pugilli.

Mr. Arthur Bennett has called my attention to the passage in Mr. Williams's *Prodromus* (i. 346) in which the latter cites for the first publication of *Utricularia neglecta* Lehm.: "Schul-programm und Vorlesungsverzeichniss des Hamburg Gymnasiums für 1828, p. 38—this old pamphlet consists chiefly of a list of children attending a local school, with an outline of the course of lessons for the term, a singular medium for the publication of new plants." Mr. Bennett adds: "This certainly would be so, but the real publication is contained in Johann Georg Christian Lehmann's first *Pugillus Plantarum*, Hamburg, 1828, and how it came in the other place it is now impossible to ascertain."

From a nomenclatorial point of view the matter is of no importance, for the date as will have been seen is identical in each case, so that the question of the validity of publication in a "Schulprogramm" does not arise, and *U. neglecta* is now by common consent referred to the earlier *U. major*. But a few points in connection with the *Pugilli* seem of sufficient interest to place on record.

The first *Pugillus*, containing 29 species, appeared in Nova Acta Acad. Caes. Leopold-Carol. xiv. part 2, pp. 799–826 (1829), with an additional footnote on the first page which explains its origin: "*Ex Indice Scholarum, in Hamburgensium Gymnasio Academico a pascha* 1828 *usque ad pascham* 1829 *habendarum, Hamburgi* 1828, pugillum hunc plantarum, in Acta nostra translatum, figuris quarundam stirpium rariorum exornavimus." From this it will be seen that the plates which appear in the reprinted *Pugillus* did not accompany the original descriptions. In Nov. Acta, xvi. pp. 314–320 (1832), appeared a "continuatio" of the *Pugillus* containing descriptions of eight species of *Cactus*, with plates; this bears on its title the same date—"Acad. trad. vere a 1828"—as the first part, of which it was perhaps originally intended to form a portion. When the *Pugillus* was reissued by Lehmann as the first in his volume *Novarum et minus cognitarum Stirpium Pugillus* i.–x. (Hamburg, 1828–57), these *Cacti* were interpolated between nos. iv and v; the date 1828 which appears for this is therefore misleading as far as these eight species are concerned, for, as has been shown, these did not appear until 1832. Apart from these, the text of the reissue, which was reset and independently paged, is identical with that of the Nova Acta, save for an added note ("Obs. ii") on *Potentilla Siemensiana* (p. 33); the plates, with the exception of the *Cacti*, are included, the numbers having been cut off to bring them within the size of the reprint.

In an interesting introduction to the reprint, Lehmann, who had held the post of Professor of Natural History in the Gymnasium (of which he subsequently became Rector) gives an account of the origin of the work. In 1821 he became Director of the Hamburg Garden, of the work of which he had printed an account—*Bericht über den* *botanischen Garten hieselbst*: Hamburg 1823. He had already published in the annual seed-lists of the Garden, beginning with 1821, brief diagnoses of new plants grown therein, and these, which are reprinted textually in the *Pugillus*, are there amplified by full descriptions. The lists I have seen, although duly published with title-page and date, bear no author's name, nor are the diagnoses signed. The only plant published for the first time in the *Pugillus* is the *Utricularia* which suggested this note—a fact to which Lehmann calls attention in his introduction.

I have been unable to see the original *Schul-programm* cited by Mr. Williams; this he thought he had seen in the Library of the Linnean Society, but it cannot be found there, nor is it at the National Herbarium nor at Kew. Mr. Williams tells me that he once purchased a copy with a miscellaneous bundle of tracts; this he subsequently disposed of at a price exceeding that which he paid for the collection.

The second *Pugillus* appears to have been published independently of the *Index Scholarum*; it has a title-page, dated "Hamburgi, 1830," and the species described are first published therein; they include some of Douglas's Californian plants, which had been communicated to him by W. J. Hooker. The four following (3–6) bear no date on the title-page, but are stated to be reprinted respectively from the *Indices* for 1831, 1832, 1833, and 1834; the fourth and fifth have prefaces dated December 1831 and January 1833. The seventh and eighth are also referred to the *Index*, and have title-pages dated 1838 and 1844. The ninth and tenth were issued independently (1851, 1857): to the latter is added an index to the ten *Pugilli*.

The third *Pugillus* has no preface; in that to the fourth, which is entirely devoted to *Hepaticæ*, Lehmann thanks W. J. Hooker, who had sent him Wallich's specimens, and acknowledges plants from "alii Botanices cultores per Angliam, Francogalliam, Daniam, Germaniam obvii" as well as from "vir amicissimus J. B. G. Lindenberg," who is again mentioned in the "præmonenda" to *Pugillus* 5; this is also entirely, as are the ninth and 6–8 in great part, occupied by *Hepaticæ*.

The first portion of *Pugillus* 6—which has no preface—"De Plantis Cycadeis præsertim Africæ Australis"—was also issued separately in the same year (1834) with a titlepage and a dedication to C. F. Ecklon—"peregrinatori experientissimo amico aestumatissimo d. d. Auctor." The copy in the Department of Botany was presented to James Yates (1789–1871) whose specimens and drawings of Cycads are also in the Department; the latter will afford material for a future note. The five plates in Yates's copy are replaced by Milde's drawings from which they were made; bound with it is no. 11 of the *Allgemeines Gartenzeitung* for 1834, which contains a German rendering by Lehmann of his paper in *Pugillus* 6.

Pugillus 7 contains, besides the *Hepaticæ* already mentioned, a history of the Hamburg Botanic Garden "ex ipsis Actis collectæ" from May, 1818—the date of Lehmann's appointment as Professor of Natural History. In the 8th, the second part is occupied by a description of some of Preiss's New Holland plants, of which a complete enumeration was published by Lehmann—*Plantæ Preissianæ*—in 1844.

The 9th *Pugillus*, which has no preface, is entirely occupied with *Potentilla*—a genus to which Lehmann paid particular attention—including a complete enumeration of the species, with synonyms: on the title of this and the next, as well as on that of *Plantæ Preissianæ* the author's name appears as "Christian Lehmann." The 10th, also without preface, contains only Hepatics, with an index to all the parts.

There is no need to discuss Lehmann's other botanical work, which is sufficiently well known, but it may be well to call attention to the account of his herbarium given in Gard. Chron. 1860 (p. 362) by Edward Otto (who succeeded him as Curator of the Hamburg Garden), which is likely to be overlooked. The herbarium was subsequently broken up and disposed of in parts, the larger portion being at Stockholm (see Alph. de Candolle, *Phytographie*, p. 427).

James Britten.

LXXX. Dates of Publication.

A modern and distinctly reprehensible practice on the part of certain publishers, that of eliminating the date of publication from the titlepages of individual volumes, should be severely condemned, especially in scientific literature. The matter is perhaps of slight importance in the case of ordinary ephemeral literature, but all systematists will agree that the date of publication is of prime importance. A case in question is presented by the late F. Manson Bailey's *Comprehensive Catalogue of Queensland Plants*, regarding which I recently had occasion to determine the date of publication. I received a complimentary copy from the author in May 1913, with Mr. Bailey's card dated March 25, 1913. No date appears on the titlepage. The prefatory notes were dated November 22, 1909, and this would naturally be the date accepted by an individual who made only a casual examination of the work. On page 835, following the short introductory paragraph under Addenda and Corrigenda, the date December 1912, appears, which is probably the date on which the manuscript for this particular part of the work was submitted to the printer. Mr. C. T. White, Government Botanist, Brisbane, Queensland, informs me, under date of March 30, 1920, that the Government Printer could give him no definite information as to the exact date of publication of the work. He states that a single volume, lacking a few of the coloured plates, was in Mr. Bailey's hands at the end of 1912, but that delivery of it for distribution did not take place until March, 1913. Most of the local letters of acknowledgement are dated March 1913. It would seem then that March 1913 should be accepted as the date of issue of the work in question.

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SHORT NOTES.

IMPATIENS GLANDULIFERA Royle (*I. Roylei* Walp.: see Journ. Bot. 1900, 87) FORMA ALBA. Although I am not able to find any definite botanical characters by which this handsome plant is differentiated from the type, I think it deserves a name and a note. It does not seem to be generally known—Sir David Prain tells me they do not have it at Kew, and the only garden in which I have seen it save those to which I have introduced it is that of Miss Jekyll at Munstead, where in 1914 it was growing in masses at the back of a long mixed border, for which it formed an admirable background and whence my seeds were derived. The plant is always of very erect and robust habit and sometimes attains a height of six feet; the flowers are pure white, and during the six years I have grown it have never shown the slightest tendency to revert to type—this is also Miss Jekyll's experience; the stems, the branching of which is very symmetrical, are light green and the foliage is usually lighter in hue than that of the type. Miss Jekyll does not know whence she obtained the plant, but thinks it was from Norwich. It is a most prolific seeder, and hence may readily become a nuisance; but for rough open spaces where it will not interfere with anything else, it would be exceedingly effective. Later in the season I shall be glad to send seeds to anyone who cares to send a stamped envelope for the purpose: I have already introduced it to gardens in England and Ireland to the satisfaction of those who have grown it, save for the drawbacks presented by its great fertility. The form seems to me at least as worthy of a name as that figured and described by Sir Joseph Hooker (Bot. Mag. t. 7647) as *I. Roylei* var. *pallidiflora*.—JAMES BRITTEN.

ŒNANTHE CROCATA L. In Bentham & Hooker's *Handbook* it is stated that the juice of this plant becomes yellow when exposed to the air. Beyond a yellowish tinge on a broken piece of stem, I have not succeeded in seeing the yellow juice. I smeared a piece of paper with the juice, and it left no stain. You will, perhaps, excuse my troubling you with such a simple point, but the statement seems misleading, especially to beginners.—W. A. NICHOLSON.

[Withering (*Arrangement*, ed. 7, ii. 382) speaks of the root as "abounding with an orange-coloured, fetid, very poisonous juice, such as exudes less plentifully from all parts of the herb when wounded." An editorial note quotes Miller as saying that "the juice is at first like milk and turns afterwards to a saffron colour": Miller also says (Dict. ed. 8) that "the stalks, being broken, emit a yellowish fœtid juice." The editorial note quoted mentions on the authority of Prof. (afterwards Sir W. J.) Hooker "a remarkable variety, if not a new species, occasionally observed in the neighbourhood of Plymouth, yielding merely a watery fluid instead of a fetid yellow juice."—ED. JOURN. BOT.]

ORCHIS HIRCINA IN SUSSEX. A specimen of *Orchis hircina* was found near Lewes, Sussex, in June last by Miss May French, a school-girl who was collecting a bunch of wild flowers for a village flower-show. The spike was in bud when picked, and she thought it was a Butterfly Orchis, but when the flowers opened her mother guessed it was the Lizard Orchis from the shape of the flowers. The specimen was exhibited at the Wild Flower Exhibition at Lewes, and has been presented to the National Herbarium. The spike bore sixteen flowers!—E. J. Bedford.

[Dr. A. H. Church informs us that a specimen of *O. hircina*, collected near Oxford, was recently left in the Laboratory there.—Ed. Journ. Bot.]

REVIEWS.

The Origin and Development of the Compositæ. By James Small, D.Sc., Ph.C., F.L.S. New Phytologist. Reprint, No. II. 8vo, boards, pp. 334. Wesley & Son. Price 15*s.* net.

An eminent scientist with a *penchant* for spiritualism some years ago humourously complained that his sceptical friends were wont to arraign him as being, like the man in the comic poem who lodged at a baker's, "two single gentlemen rolled into one": while his feet remained on the "solid ground of nature" he was Orthocrookes, but he became Pseudocrookes the moment he deviated into the supernatural. The perusal of this collection of reprints from the *New Phytologist* has recalled the story to mind. Two persons are to be seen in Dr. Small—one an eager student of the known, industriously marshalling authorities and framing suggestions in such a way as to give valuable information concerning the *Compositæ*; the other a sort of Diogenes with a difference, who lights his candle and proceeds to search for what is "primitive." This quality of primitiveness is to Dr. Small as King Charles's head was to Mr. Dick, and the reader unqualified to pronounce an opinion on so complex a subject finds himself, like Rosa Dartle, asking "why?" when confronted with these confidently offered assumptions.

We are to consider, it appears, the truncate-penicillate style as typical, all others being modifications of it. Stamens having anthers with cells truncate and unappendaged at the base constitute "obviously the primitive and characteristic stamen for the family." Irritability of the pollen-presentation mechanism—a subject discussed in a very interesting manner—leads Dr. Small to conclude that, of the three main types A, B and C of movement, C is the most primitive because it involves only one step—the contraction of but one of the five filaments; while A and B, involving more than one, are therefore less primitive. Further we are to regard as primitive the yellow tubular corolla; as primitive, too, the pappus with scabrous setæ, such pappus being trichomal in nature; also the uniseriate involucre and the smooth or foveolate receptacle. Our eyes being thus opened, behold as "the first genus of the *Compositæ* to come into existence" which has "directly or indirectly given rise to all the other genera of the family," the genus *Senecio*!

The Age and Area hypothesis is claimed as confirming this conclusion; but one would like to ask Dr. Small, in view of the scantiness, really amounting to virtual non-existence, of the geological record, whether he has ever realised the errors a zoologist, in the absence of fossilised remains, would most likely fall into who should endeavour to apply that hypothesis to, say, the Mammalia? And if palpable mistakes would almost certainly be made in dealing with the animal world, what assurance have we of safe ground for speculation when plants are in question? In accordance with the hypothesis, Dr. Small considers *Senecio* to be clearly marked out as primitive on account of its wide distribution in space. *Gnaphalium* is the only genus, he says, which can claim anything like equality with *Senecio* on this ground; but here he overlooks *Aster*, for he cannot be unaware that the Southern *Felicia* and *Olearia* are merely geographical offsets which have actually been included in *Aster* by botanists of repute. The question then is where did this primitive genus arise? The centre of origin is indicated "by the coincidence of the region of concentration of local species with the region of the overlapping of the areas of the widespread species," and this shows the centre of origin of *Senecio* (from a Lobelioid ancestor) to be the Bolivian region. Similar conclusions drawn from present-day distribution are put forward with respect to all the Composite tribes. These are pure assumptions, which may be true in some cases and hopelessly erroneous in others; as applied to *Senecio* they do not seem very happy. All that can safely be said is, that at some time after the Andine uplift began, *Senecio* was represented in that part of the world: the contingent earth-movements resulted in the formation of hundreds of isolated valleys, thus bringing about conditions most favourable to specific differentiation. This would account for the large number of Andine species, but it tells us nothing concerning the first appearance, there or elsewhere, of the genus.

The author's treatment of the pappus, although ingenious, is by no means satisfactory. To say that the setæ are composed of hairs variously united and to infer from this that all forms of pappus are similarly composed, is surely to ask more than can be granted. And when we find the main point evaded round which controversy has raged—namely the homologies of the pappus—the only conclusion to be drawn from the claim that the application by him "of a little microscopy combined with an obvious application of elementary physiological facts removes the clouds of controversy" from this vexed question is that he is the victim of delusion.

Of course we have the inevitable phylogenetic tree; but why *Senecio* should appear comfortably installed in the Upper Cretaceous period when no remains attributable with any certainty to the genus have been found in strata below the Pliocene, is known to Dr. Small alone. But this is sobriety itself when compared with the last chapter headed "The Story of the *Compositæ* in Time and Space." A short extract from this will give an idea of its tenour. "Just as its" [*Chuquiragua's*] "cousin, or rather niece, *Chaptalia* raced along the mountain ranges on regaining an efficient pappus in a suitable environment, so did *Chuquiragua*. Like *Chaptalia* also, this new genus was transformed on crossing the Alaska–Siberian bridge by an increase in the corolla material, which was rendered possible by the mesophytic conditions of the upland plains of China. *Ainsliæa* is the name now given to the transformed *Chuquiragua*. This *Ainsliæa* type reached South Africa at a much later date (lower Pliocene) by means of a greater development of the pappus which made migration easier. During the journey it underwent a few other slight changes to become *Dicoma*." Concerning all this one can only say that the "phytologist" must indeed be "new" who would accept these fantastic statements at their face value.

It is not pleasant to write like this, and the less so as the work is that of a compatriot. Had Dr. Small restricted his ambition to the domain of strict observation, with here and there a cautious generalisation from ascertained facts, he might have rendered yeoman's service to students of the *Compositæ*; even as it is his book is well worth study in parts, as has already been remarked. But in his main thesis he must be held to have failed, and that not from want either of insight or of ingenuity, but because the problem he has ventured to attack is, at least in the present state of our knowledge, frankly insoluble.
S. M.

The British Charophyta. By James Groves, F.L.S. and George Russell Bullock-Webster, M.A., F.L.S. Vol. i. Nitelleæ: with Introduction, [20] plates, and text-figures. 8vo, cloth, pp. xiv., 141. Dulau & Co. Price £1 5*s*. net.

This first instalment of a work that was to have been issued complete to members of the Ray Society in 1917—a date which somewhat unfortunately appears on the back of the cover—will be welcomed by all students of the group of plants to which it refers, to whose history it is an important contribution. There is no need to point out—least of all to readers of this Journal, wherein so much of their work has appeared—the qualifications of the brothers Groves for monographing the plants at which they had worked for so many years. Their first important paper was the "Review of British Characeæ" published in the Journal for 1880; but the thorough acquaintance there displayed of the plants described and the exhaustive knowledge of the literature relating to them could only have been achieved by many years of careful and persistent work. In his notice of his brother Henry (Journ. Bot. 1913, 73–79), whose death occurred in 1912 and to whom the volume is fittingly dedicated, Mr. James Groves attributes to him "the greater part of the work and all of the drawings"; but those who know how closely the brothers were *en rapport*, not only in matters botanical, will hardly doubt that, so far as the literary portion was concerned, the honours were equal. From 1880 onwards, additions to the British list were recorded and figured in this Journal; four of the plates (including Henry Groves's beautiful drawing of *Nitella hyalina*), are reproduced in the volume before us: the other three, with twelve now published for the first time, are from the pencil of Miss Mary Groves, and are in every way admirable. Canon Bullock-Webster, joint-author of the volume, has been associated with the brothers for more than twenty years, and has made important contributions to our knowledge of the group: so that the monograph could not have been in abler hands.

After an introduction in which are discussed the position of the group, its antiquity and geographical distribution—we note with pleasure that in the second volume Mr. Groves will give some account of the fossil remains of *Charophyta* found in this country, to which, in conjunction with the late Clement Reid, he has devoted much attention—conditions of growth, and economic uses, we have an important chapter, extending over more than fifty pages, containing a very full account of "Structure and Development," with twenty-five illustrations in the text from various sources. A "conspectus of distinctive characteristics of oospores and membranes" is followed by a glossary and a table of Latin adjectival terms. Then comes the systematic account, the introductory portion of which is reprinted from the "Review" already mentioned up to the date of its publication, and supplemented by a summary of what has been done since. In nomenclature the rule of strict priority has been observed; on this subject the authors have some sensible remarks. The keys to the genera and species relate to the whole work: we observe that *Chara aspera* var. *desmacantha*, published and figured by the brothers in Journ. Bot. 1898 (p. 410, t. 391), is raised to specific rank as *C. desmacantha*—a publication which will date from the present volume, although the full description will not appear until later.

The genera described are *Nitella*, with 10 species, and *Tolypella*, with 4: in the former genus *N. capitata* Agardh is superseded by *N. capillaris* comb. nov., as the plant is the *Chara capillaris* of Krocker, its first describer. The descriptions, in English throughout, are very full; the distribution in the British Islands is carefully worked out; there is an extensive synonymy, and a list of exsiccata. It will thus be seen that the treatment is exhaustive—the only addition we can suggest is a few words on the preparation of specimens, in which, as those who are acquainted with their fasciculi know, the Messrs. Groves were experts.

The book is well if somewhat extravagantly printed; to the excellence of the plates we have already referred. It cannot be doubted that the aspiration of the authors—that the issue of these volumes may result in a large number of British botanists being attracted to the study of the Charophyta—will be fulfilled; and we trust that the second volume will be published with the least possible delay, in order that the group may be studied in its entirety.

An Introduction to the Study of Cytology. By L. DONCASTER. 280 pp., xxiv plates and 31 text-figures. 8vo. Cambridge University Press, 1920. Price 21*s*.

IT has been the unavoidable misfortune of Botany that interpretations of Cytological phenomena in plants have had always to follow haltingly behind the advance of studies on the more highly organized nuclear mechanism of animals. Botanists have still to endeavour to unravel from the technicalities of zoologists, obsessed with the remarkable constancy of their scheme of sexual reproduction, a reasonable outlook on the variety of phenomena of cytological life-history presented in plants, freed from conceptions of "maturation" and "germ-cells."

A very full and clear statement of the general facts of mitosis and meiosis in animal types is followed by theoretical discussion of modern cytological problems, the botanical side being practically restricted to slight notices of chromosome-behaviour in mutant-hybrids of *Œnothera*, tetraploid Primulas, double Stocks, and rogue Peas. Though the bias of the work is distinctly zoological and Weismannic, there is much that is absolutely indispensable to the botanical student. No biologist can afford to neglect questions of linkage, sex-determination, the role of chromosomes in Mendelian segregation, or views of their more intimate structure, particularly as suggested by the story of the *Drosophila* fly. A brief and clear statement of the general facts from the zoological side is a botanical necessity, and the present volume presents the case as neatly as may be, and not at too great a length. A. H. C.

BOOK-NOTES, NEWS, ETC.

In the *Journal of the Linnean Society* (Botany, xlv. no. 301) issued July 8, Mr. N. E. Brown has a long and important paper on "New and Old Species of *Mesembryanthemum*, with critical notes." He prefaces it by an account of the history of the genus, starting with the works of Haworth (1794–1821), whose descriptions are elucidated by the large collection of drawings in the Kew Herbarium by George Bond and Thomas Duncannon, many of them made from the types of Aiton's *Hortus Kewensis*. He calls attention to the need for a thorough revision of the nomenclature of all the species, and gives the emphasis of italics to the remark that "this work can only be effectually accomplished by an investigation of the information stored up in the Kew Herbarium and at the British Museum." Mr. Brown is of opinion that some of the plants in the "Sphæroid" group should be separated generically, but for the present retains them as sections of *Mesembryanthemum*, with a diagnostic Key. A large number of new species are described, many of which are figured on the six plates (printed in a curious but not unpleasing violet tint) by which the paper is illustrated. The importance of the British Museum collections forms the text for Mr. Britten's paper on "Some early Cape Botanists and Collectors," which is briefly summarized in this Journal for 1918, p. 63. It is accompanied by a portrait of Francis Masson,—whose important collections, still imperfectly examined, are in the National Herbarium—reproduced from an oil-painting bought from a general dealer at Hounslow by Mr. Carruthers, and by him presented to the Linnean Society. A review of the genus *Chlorochytrium*, by B. Muriel Bristol, M.Sc., with three plates, and a description of a new *Lobostemon* (*L. magni-*

sepalum) by Mr. N. E. Brown, from a unique specimen in the Linnean Herbarium, make up a number of unusual interest.

Science Progress for July contains a long paper by Dr. F. H. Perry Coste and his daughter on "Cornish Phenology," in which observations made systematically at Polperro during 1912–1919 are summarized and tabulated. They are selected from the diaries kept by Miss Perry Coste in connection with the "Wild Flower Society" "the members of which, divided into some twenty branches, keep diaries of the dates of flowering of all the wild flowers they can find, and compete for first place in the branch..... two marks are given for the earliest record . . . and the system has resulted in the accumulation of records which have indubitable phenological value and should certainly be utilised": this has been done in the paper referred to with great care, and the results are of considerable interest. It may be noted that, from an early period, Cornwall has been associated with phenological observations. In the *Tenth Annual Report of the Royal Cornwall Polytechnic Society* (1842: pp. 33–40) is a "Calendar of Natural History" extracted from diaries kept at Polperro by Jonathan Couch (1789–1870), the dates, which include those relating to birds, etc., and are not very numerous, begin with 1808. In the Sixteenth Report of the same Society (pp. 25–28) his son, Thomas Quiller Couch (1826–1884), published a "Botanical Register for 1848 kept at Polperro" in which are given the dates of first and last flowering and of foliation and defoliation. His observations were based on the lines laid down by Quételet, of which he gives a full summary in the important Calendars kept at Bodmin from 1864 to 1875 published in the *Journal of the Royal Institute of Cornwall* for 1864–1878 (vols. i.–v.). Perhaps the most extensive series of phenological observations was that made by T. A. Preston (1833–1905) when master at Marlborough, where he had the co-operation of members of the School Natural History Society; these will be found in this Journal for 1865 (p. 203) and 1868 (p. 180) and, for a series of years, in the *Reports* of the Marlborough N. H. S., and in the *Quarterly Journal of the Meteorological Society*. When Preston left Marlborough, he became rector of Thurcaston, where—somewhat on the lines of J. S. Henslow (1796–1861) at Hitcham—he interested the children of his school in "first appearances," offering a reward of a farthing for a satisfactory report. An indication of the first and latest date and mean time of flowering is a noteworthy feature of his Flora of Wiltshire. It is to be regretted that Dr. Coste's paper should be disfigured by numerous misprints, of which *Potentilla tonmentilla*, *Eupatorium cannabiense*, *Heracleum spondyllium* are examples: the rule by which generic names used for species are spelt with a capital is ignored throughout.

The New Phytologist for May and June (published July 10) contains a continuation of Dr. R. R. Gates's observations on "Mutations and Evolution," the botanical portion of which is mainly occupied with *Œnothera*, and a paper by Dr. J. C. Th. Uphof, illustrated by numerous figures, on the "Physiological Anatomy of Xerophytic Selaginellas."

PROFESSOR MATSUMURA's useful *Icones Plantarum Koisikavenses*—figures with descriptions of new and rare plants in the University of Tokio—is now in its fourth volume. The number for May contains excellent figures and descriptions (in Latin and Japanese) of *Leontopodium leiolepis*, *Pertya macrophylla*, and *Aconitum hondense*, by T. Nakai.

THE *History of Tong, Shropshire* (ed. 2: 1894) by George Griffith contains a long account of the tree shown as the "Boscobel Oak," with quotations from various writers concerning it. The author records his conviction that this is "one and the same tree which sheltered the royal and jovial, if unworthy, King" and this conviction "prompts [him] to commit to paper some notices and notes to quell the storms of detraction which gather round this and similar marks of antiquity." Of White Ladies Abbey, near Tong, he says: "Here grew the yellow saffron or autumn crocus, which an old herbalist informs me, grew at Tung (*sic*) and all Romish places; there still grow the Myrrhis Odorata, a relic of the Nuns' herb-garden, and other rare plants." What plant can have been intended by "yellow saffron"?

The *Daily News*, whose botany we have more than once had occasion to criticize, published on July 19 this interesting note "on Garden-flower Names":—"A friend in Kent was very much struck by the glories of a border of pentstemons in a cottage garden, and she stopped to chat with the old man in charge of it. A few days later he presented her with a big bunch of blooms. 'I thought,' he said, 'as you'd like a few of my French demons.' 'Gay ladies,' for gaillardias, is another version—a quite good one—of a garden-flower name. Those who know the fiery orange of the eschscholtzia, or Californian poppy, will think the common 'a scorcher' an equally appropriate name. Fortunately in the country we still stick to the old names for snap-dragons, larkspurs, monks-hood, and so forth. You have to go to the London street markets to get the Latinised forms, which are usually rendered in some such versions as these: Antiryneum, Aunty-Rinum; Dolphyneum, Dorfinnyum; Alkonitum (aconitum); Gipsy-Ophelia (for gypsophila); Nemerney (anemone). Antirrhinum and pyrethrum are the two plants which are most often called out of their names."

From the same source comes the following, which are perhaps too frivolous for our serious Journal: "The park had once been a private estate, and the old gardener has spent the greater part of his life teaching the ground to say [grow?] flowers. 'Could you tell me to what family this plant belongs?' inquired a teacher conducting her class through the park. 'I happen to know it don't belong to no family,' returned the old man indignantly, 'it belongs to this here park.'

"The story of the gardener and the plant reminds a correspondent of the other gardener at Kew. He listened to a teacher discoursing to his class under a tree in the Gardens. He called the tree an elm, and pointing out that the elm had been introduced into Britain by the Romans, asked rhetorically: 'If this elm could only speak what history it could tell us! I wonder what it would say.' And the gardener, disgusted: 'It would say,' 'I'm not a helm; I'm a hoak!'"

"JOURNAL OF BOTANY" REPRINTS.

In view of the fact that the stock of these is in some cases practically exhausted, the attention of our readers is directed to the list which appears on the following page. Old subscribers of course already possess the matter contained in them in the pages of the *Journal*; but some of them appeared several years ago, and recent subscribers will thus not possess them. Some, which do not appear in the list, are already out of print; of others very few copies remain, and it will of course be impossible to reprint them: among the latter may be mentioned Mr. Dallman's *Notes on the Flora of Denbighshire* (1911), and Mr. Bennett's *Supplement to 'Topographical Botany.'* Of the Supplements to the *Biographical Index* no complete sets remain. It had been hoped before this to issue the second edition of the work, in which these Supplements are of course incorporated, but the present cost of paper and labour has rendered this impossible. Of the *Index* itself no copies remain, these having been lost in the course of transferring the stock to Messrs. Adlard. Mr. Garry's *Notes on the Drawings of Sowerby's 'English Botany,'* containing, as it does, much topographical information and numerous unpublished notes by Smith, Sowerby and others, should be in the possession of all interested in the history of British Botany: only sixteen copies remain.

It may be pointed out that, although for the most part relating to British Botany, certain of the reprints have a more general appeal. Such are the *Index Abecedarius*—a list of the plants in the first edition of Linnæus's *Species Plantarum*, showing at a glance what are included in that work, which has no index of species; the *History of Aiton's 'Hortus Kewensis,'* which contains much information as to the authors and contents of that classical work; the *Flora of Gibraltar*, which, besides a complete list, contains notes on the more interesting species; Linnæus's *Flora Anglica*—the first English Flora—has a bearing upon nomenclature: of all these there are numerous copies.

[*Over.*

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No. 693 SEPTEMBER, 1920 Vol. LVIII

THE JOURNAL OF BOTANY

BRITISH AND FOREIGN

EDITED BY

JAMES BRITTEN, K.C.S.G., F.L.S.

LATE SENIOR ASSISTANT, DEPARTMENT OF BOTANY, BRITISH MUSEUM.

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The Journal of Botany was established in 1863 by Seemann. In 1872 the editorship was assumed by Dr. Henry Trimen, who, assisted during part of the time by Mr. J. G. Baker and Mr. Spencer Moore, carried it on until the end of 1879, when he left England for Ceylon. Since then it has been in the hands of the present Editor.

Without professing to occupy the vast field of general Botany, the Journal has from its inception filled a position which, even now, is covered by no other periodical. It affords a ready and prompt medium for the publication of new discoveries, and appears regularly and punctually on the 1st of each month. While more especially concerned with systematic botany, observations of every kind are welcomed. Especial prominence has from the first been given to British botany, and it may safely be said that nothing of primary importance bearing upon this subject has remained unnoticed.

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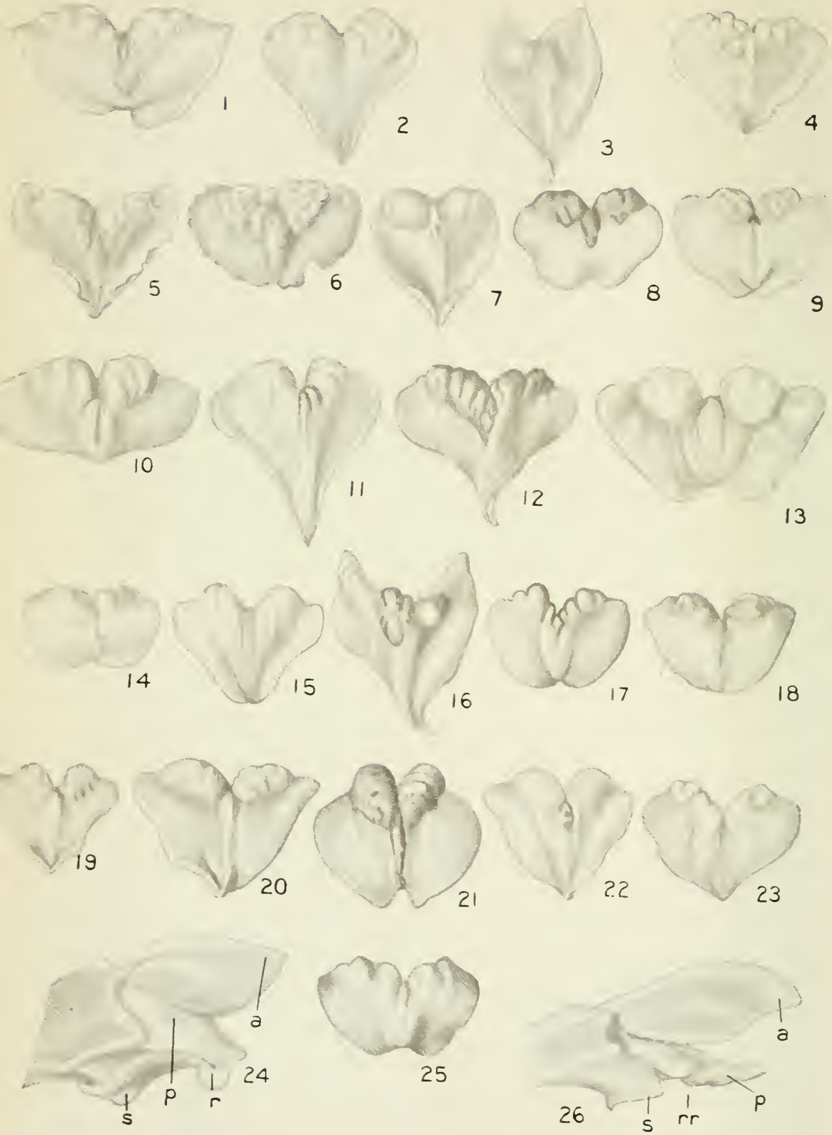
Plate 555.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Nos. 1–23 and 25, Lips of *EPIPACTIS*, enlarged.
Nos. 24 and 26, Reproductive Organs of *E. LATIFOLIA* and *E. VIRIDIFLORA* var. *LEPTOCHILA*, respectively.

a, anther-cap; *s*, stigma; *p*, pollinia; *r*, rostellum; *rr*, rudimentary rostellum.

THE GENUS EPIPACTIS IN BRITAIN.

By T. Stephenson, D.D., and T. A. Stephenson, M.Sc.

(Plate 555.)

We have made the critical species of the genera *Orchis* and *Epipactis* our study for several years, and had prepared a paper on the subject with numerous illustrations, which we find would be too costly to produce as a whole; but we hope to print two of the plates and the more important part of the text in a series of short contributions to this Journal. The Plate accompanying the present note will illustrate some of our points with reference to *Epipactis*, the next communication will deal similarly with *Orchis*. We are publishing the Plates first, with a summary of our ideas corresponding to each, so that reference can be made to the figures in later papers amplifying the text of the summaries.

Our present concern is with *Epipactis*. We have had unusually good opportunities of observing numerous specimens of the commonest forms, and also, to a lesser extent, the rare ones. The main part of our material for the *E. latifolia* group is from Aberystwyth, but we have obtained living specimens from various distant localities for confirmation. We would add a warning that nothing can be done with the genus *Epipactis* from pressed plants, and but little with *Orchis*—fresh material is essential. By way of compensation, it is very easy to preserve the flowers in spirit—the colour, of course, is lost, but the form is perfectly retained and without shrinkage.

Our conclusion is quite definitely that the genus *Epipactis* is represented in Britain by five good species only:—*E. palustris* Crantz, *E. atropurpurea* Raf., *E. viridiflora* Rchb., *E. purpurata* Sm., *E. latifolia* Allm.

E. palustris is so distinct that it requires no comment. *E. atropurpurea* (=*E. ovalis* Bab.,=*E. rubiginosa* Crantz,=*E. atrorubens* Sch.) is, in our experience (we have seen forms from Great Orme, Ireland, and Grassington), quite easily recognised and not to be confused with *E. latifolia* at all. Its small flowers with a broad epichile, which has usually 3 very rugged elevations, often confluent, its rough ovary, and its small neat leaves, the bottom one usually purple beneath, are points which distinguish it from *E. latifolia*, apart from its typically small size and often rich dull purple flowers. Even if the flowers are green, however, other points distinguish it.

E. purpurata (=*E. violacea* Bor.,=*E. sessiliflora* Peterm.) is equally distinct. Whether or not the stems grow in tufts, the leaves are generally much smaller and more delicate in texture than in *E. latifolia*, and are tinted with a fine violet which turns their green to grey, except in an odd plant here and there which has green but delicate leaves. The bracts may be very long and narrow. The flower seems to have a constant colour-scheme—the ovary dark green or purple-tinged, the petals pale whitish green, the sepals more definitely green, especially outside, the lip whitish green with usually pale lilac elevations on the epichile. The lip usually has a more or less developed small central "boss" as well as larger lateral elevations, which vary from nearly smooth to much wrinkled.

E. viridiflora still seems to be mixed up with *E. latifolia*, but there is no need for this, because, although it varies very much in other ways, the reproductive organs always afford a good distinction. They are arranged for self-fertilisation; the friable pollen falls on the receding stigma, and there is little or no rostellum. In *E. latifolia*, *atropurpurea*, and *purpurata* the pollen is less friable, the rostellum is well developed, and the stigma is pushed so far forward that the pollen cannot fall on to it. As far as the rest of the plant is concerned, it sometimes resembles slender greenish specimens of *E. latifolia* quite closely, but usually is more delicate if growing in woods, more slender and wiry and yellower if growing in sand-dunes. It flowers at the very least a fortnight earlier. The leaves are often small, the flowers small to medium, the colour green or whitish green, with not much brown tinge. Lip a triangle with a long point in woodland forms, the point curled under in dune-forms; usually not much development of roughened elevations on the epichile. Ovary smoother than in the other species, may be almost glabrous.

E. latifolia in our scheme is a name which includes *E. media* Fr. and *E. atroviridis* Linton as synonyms. We hope to amplify our results on this species in a later paper, but may give the conclusion here as follows:—

i. *E. media.*—Col. Godfery in this Journal (1919, 80) has already shown that *E. media* Fries is a *nomen nudum*, and that *E. media* Bab. is *E. viridiflora*, so that the name "*media*" is completely wiped out. We have independently concluded that no distinction is possible between *E. latifolia* proper and *E.* "*media*" as it has been understood before Col. Godfery's papers. The supposed differences between these two were, that in *E. latifolia* the leaves are broad and there is a sudden transition from the fairly large top leaf to the small lowest bract, and that the lip has two smooth bosses or elevations on the epichile; whereas in *E.* "*media*" the leaves are narrower and the transition to bracts is gradual, the epichile having two "plicate-rugose" bosses. We have rarely found plants with *quite* smooth bosses on the epichile, and these usually have the "*media*" type of leaf! There is every sort of gradation from smooth to very rough and pitted elevations, and one finds every sort of elevation combined with every possible sort of leaf-scheme; for there are all grades of leaves too, from broad to narrow, and one gets narrow leaves with abrupt transition to bracts, and broad leaves with gradual transition, as well as the reverse, and all sorts of other variations as well. In other words, one finds "*media*" flowers with "*latifolia*" leaves and *vice versâ*, and the majority of plants are not exactly one or the other, every grade of variation being present which affects these characters.

ii. *E. atroviridis* Linton.—The chief supposed diagnostic character of this is that there are three roughish bosses on the epichile. We find that the original description of *E. atroviridis* would fit a specimen of *E. latifolia* here and there, but that it is as common to find 3 bosses as 2, and that the two conditions grade into each other—the middle one may be large, small, minute and distinct, or confluent with the others. Also, there may be 3 bosses on the lip combined with *any possible* type of leaf-scheme, broad or narrow, bracts large or small, narrowing from the leaves gradually or suddenly. We think, therefore, that *E. atroviridis* cannot be a valid species, but that it is a term only applicable to some specimens of *E. latifolia.*

iii. We come, therefore, to the conclusion that lip-bosses and details of leaf-scheme are so very unstable that they cannot possibly be considered good specific characters, and should be dropped; that the common British species is *E. latifolia*, and that "*media*" and "*atroviridis*" should be merged in it and allowed to lapse. The species is obviously very variable in minor details, but could not be mistaken for any of the others, in our experience. It may or may not be possible to distinguish varieties within it. The flower may be almost any colour, from deep purple (and this may grow in deep shade!) to greenish of various kinds, and nearly white.

iv. The suggestion will, of course, be made that *E. latifolia*, *E. media*, and *E. atroviridis* are really distinct but hybridize freely. We do not think this to be the case. We have had a good deal of practice in the detection of hybrids, and in the genus *Orchis* have found that it is possible with fair certainty to distinguish clearly definite species among the palmate forms, and to identify hybrids between them: there are stable characters for distinction. In *Epipactis*, however, the variation in the *E. latifolia* group is quite a different sort of thing, and to distinguish species and hybrids is not possible. When a hybrid in this genus *does* come forward it can be clear at once—we have a fine specimen from Grassington of *E. atropurpurea* × *E. latifolia*, about which there is no doubt.

We may now consider the accompanying Plate in more detail, which will illustrate some of the above points. We cannot unfortunately afford to print our figures of leaf-schemes to complete the demonstration, but will refer to those in more detail later.

Explanation of Plate 555.

All the figures except nos. 24 and 26 are enlarged views of the epichiles of various plants.

Figs. 1 to 3. E. viridiflora. Note the absence of any very considerable ruggedness in these lips. Fig. 1 is the dune-form from Southport, with the tip of the lip curled under so that it gives the lip a broad appearance, and the bosses more wrinkled than in the woodland forms. Figs. 2 (*vectensis*) and 3 (*leptochila*) show the long-pointed triangular form with the bosses moderately inconspicuous and not much wrinkled.

Figs. 4 and 7. E. purpurata. These are from Surrey specimens. There is nothing very particular to notice here beyond the fact that there is a small central boss and that the lateral bosses are more wrinkled in one than the other. Fig. 7 is from a young lip not quite fully unfolded, which accounts for its narrow form.

Fig. 6. E. atropurpurea. From N. Wales. This shows the rounded form of lip and the very markedly roughened bosses, the central one large and conspicuous, though not very sharply separated from the others, with which it is sometimes confluent.

Fig. 5. E. atropurpurea × *E. latifolia.* We give the lip of this hybrid for its general interest—the influence of *E. atropurpurea* may be seen in the bosses, but, of course, the determination of the hybrid was largely connected with the rest of the plant. Note the distinctly incurved edges of this lip.

Figs. 8 to 23, and fig 25. E latifolia.

Here it should be noted that there is not much to be gained by considering the relative length and breadth of the lip. It varies very much, and there are so many degrees of curling under of the tip that this affects the appearance when the lip is seen from the front—many of the figures look broad because the point happens to be tucked back so as to be invisible.

Fig. 8. (Canterbury.) Lip with 3 quite distinct bosses, not smooth. Leaves of this plant were of medium breadth, passing gradually into bracts.

Fig. 9. (Owl Wood, Surrey.) Lip with two clearly marked off side-bosses, which are very finely wrinkled with a minute but definite centre-boss between them. Leaves of the broad type with abrupt transition to bracts.

Fig. 10. (Cardigan.) A lip with 3 bosses, the central one large and prominent, all three of them with a few simple wrinkles. Leaves of the "*media*" type.

Fig. 11. (Cardigan.) A slenderer lip than 10, with the tip not curled under. Bosses forming a rather vague generalised elevation and fairly smooth. Leaves fairly narrow.

Fig. 12. (Cardigan.) This shows the extreme wrinkled type, and the three bosses more or less confluent.

Fig. 13. (Cardigan.) This is a lip with well-separated, smoothish side-bosses, with a shallow central elevation, not a concentrated boss. Leaves moderately broad below, grading off into bracts.

Fig. 14. (Cardigan.) Bosses slightly marked and fairly smooth, slight central ridge. Leaves of almost the narrowest type, transition to bracts not very gradual.

Fig. 15. (Cardigan.) Smooth bosses and a wide central groove. Leaves narrow.

Fig. 16. (Cardigan.) The bosses here are concentrated into a knot in the middle, and there is a long shallow median tongue. Leaves all broad.

Fig. 17. (Cardigan.) Minute distinct centre-boss and fairly rugged lateral bosses.

Fig. 18. This is a lip from a plant sent us by Rev. E. F. Linton as probably *E. atroviridis.* The central boss is not so much a boss as a ridge, the side-bosses are fairly wrinkled in a slight way. The leaves were of medium width, the graduation to bracts not very gradual. Leaves curiously acuminate from a broad base.

Fig. 19. (Cardigan.) Slightly wrinkled side-bosses and central ridge. Leaves broad with very abrupt transition from large upper leaf to small lowest bract.

Fig. 20. (Cardigan.) Central ridge and slightly wrinkled side-bosses. Leaves so broad below as to be orbicular, but gradually tailing off by many gradations into narrow bract-leaves above.

Fig. 21. (Cardigan.) Here the bosses are very elevated and clear-cut, and the narrow central boss is clearly marked out from the others.

Fig. 22. (Cardigan.) Smooth side-bosses and a shallow triangular central elevation with a small boss upon it.

Fig. 23. (Owl Wood, Surrey.) No centre boss. Side-bosses fairly rugged. Leaves broad.

Fig. 25. (Cardigan.) Fairly wrinkled side-bosses and slight central elevation. Leaves very broad.

Figs. 24 and 26. Reproductive organs.

Fig. 24 shows the organs of *E. latifolia*, and Fig. 26 those of *E. viridiflora* v. *leptochila.* The difference between the slender organs of *viridiflora* with receding stigma, friable pollen-masses, and rostellum so small as to be barely visible; and the stouter organs of *latifolia* with stigma pushed well forward, more coherent pollen-masses, and large rostellum, is well brought out.

It will be clear from a study of the lips of *E. latifolia* shown above how very much and in what elusive ways these lips vary as far as most of their details are concerned. The grades of variation, indeed, are so difficult to separate that hardly any two people will quite agree as to the exact words which should be used to describe any given lip. We hope that the figures will illustrate our case where verbal description is at fault.

Errata in paper on *Orchis purpurella* in July issue :—
p. 167, line 23 : *for* "35 cm." *read* "15 cm."
p. 169, line 18 : *for* "leaf-pattern" *read* "lip-pattern."

THE LICHEN SYMBIOSIS.

By A. H. Church.

"*Lichens are symbiotic organisms, they consist of higher Fungi, chiefly Ascomycetes, more rarely Basidiomycetes, and unicellular or filamentous algæ, living in intimate connection, and together forming a compound thallus or 'Consortium' . . . . and have been so evolved as consortia that it is more convenient to treat them as a separate class . . . . From the symbiosis entered into by a Lichen Fungus with an alga, a dual organism results with a distinctive thallus, of which the form (influenced by the mode of nutrition of the independently assimilating alga) differs greatly from that of the non-symbiotic Eumycetes*"[1].

These sentences admirably illustrate the manner in which it is usual to teach the Lichen at the present day, emphasizing (1) the marvel of the symbiosis, (2) the 'dual' organization, and, above all, (3) the novelty of the growth-forms thus produced—so distinct from other vegetation—that (4) the plants require to be taken in a special chapter[2] or section[3] away from Fungi proper; as also they may be investigated and catalogued by special monographers[1] as a wholly new and unique development in subaerial vegetation[2]. One is thus encouraged to regard a Lichen as a pleasing triumph of socialistic biology, the expression 'dual organism' being meaningless, unless it also implies a divided control, and that the Lichen, so to speak, has not a soul to call its own. On the other hand, it is often difficult to convince the wholly unbiassed student that there is anything in the phenomena beyond the pure holoparasitism of a special set of Fungus phyla, admittedly polyphyletic as are other phenomena of parasitism, and that the 'symbiosis' is wholly imaginary or woefully exaggerated. The general facts of the story may be therefore examined in further detail; since whatever be the present state of the relation of the component organisms, there can be no question that such a biological phenomenon must have had a remarkable origin; and all the greater interest will centre in the discussion of the conditions which may have induced such a state of affairs.

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[1] Strasburger, *Textbook of Botany*, Engl. Trans. p. 417 (1912).

[2] Schenk in Strasburger, *loc. cit.*

[3] Fünfstück in Engler and Prantl (1898–1907).

The word symbiosis, borrowed from zoological usage is admittedly a perfectly meaningless expression, in that any strict definition as to what is intended, from the vaguest *commensalism* is pure *holoparasitism*, has to be read into it arbitrarily; and in such case, as often happens, it may be employed as a dangerous half-truth to obscure the really interesting facts of the more fundamental nature of the association[3]. In the widest sense of 'mutual benefit' to both parties concerned, however small the advantage may be to one of them, there can be no objection to its use; but this is a proposition very different from 'the evolution of a dual organism.' It is the 'consortium' which requires fuller justification: what exactly may be intended in the connotation of such a term, and how it is biologically expressed in novel form, as something quite distinct in the realm of modern vegetation. The general facts are sufficiently clear and accepted. The 'gonidia' of a Lichen are admittedly simple algal protoplasts, of typically discrete organization, averaging 10–12 μ diam., in all more successful Lichens, and they belong to groups of lowest grade Algæ; whether more 'primitive' (Cyanophyceæ), or decadent and aflagellate (as Protococcoideæ); less frequently Ulotrichales of fresh-water rather than marine habitat (*Trentepohlia* = *Chroolepus*)[4]; in which somatic organization is reduced to the limit of simplicity[5], and reproductive organization is wholly wanting or omitted. Cases involving more distinctly filamentous algal growth, as in cœnocytic *Cladophora* and *Vaucheria*, are unconvincing, since the symbiosis does not attain either a reproductive stage or a tissue-system in the soma; and such cases grade into the condition of simple parasitic attachment noted in the association of Fungus hyphæ with the protonemata of Mosses[1], the prothallia of Pteridophyta, not to mention the connection with larger algæ as the endoparasites of Fucoids[2]. Such phenomena at once introduce the difficulty of determining what is really a simple Fungus-attack, and what is to be regarded as attaining the dignity of a Consortium. The Fungi, again, follow the general formula of known Ascomycete or Basidiomycete groups; there is nothing very exceptional about them in their more characteristic reproductive processes[3]; the hymenium is always normal; as, for example, in details of ascus-production, or protection, as also in spore-discharge or septation, with few anomalies; they show nothing that is new beyond what may be expected in quite ordinary holosaprophytic Fungi[4]. But, once 'synthesized,' to use the commonly accepted expression, they apparently acquire a wholly new somatic organization, giving them a morphology and habit all their own; and it is this latter relation that is to be expressed by the term 'consortium' and 'dual organization.' The botanists who first demonstrated the algal nature of the 'gonidia,' being more concerned with the story of the reproductive processes, or the actual establishment of the synthesis, were less impressed by this remarkable consequence (De Bary, 1865; Schwendener, 1868; Stahl, 1877; Bonnier, 1889); and later writers (Reinke, 1895; Goebel, Organography, Eng. Trans. 1900) first drew attention to it. The expression 'dual organism,' of course, may be used quite as well for a *Cordyceps* growing from a living caterpillar, or even for a tree-trunk with abundant Polypori emerging from it, or, again, smothered in Mistletoe; but such combinations are clearly not intended to be included in the conception of a 'consortium'—that is to say, the expression 'dual organism' is meaningless unless it is intended to cover a *dual control*; though it may be difficult to determine exactly where such dual control may be localized, when two organisms are not in direct protoplasmic continuity, beyond each going its own way irrespective of the other, so far as possible. Definite examples of dual organism are presented in grafted trees, with fusion of conductive tissues; but this would not be regarded as a successful natural type of organism. The most perfect expression is that of Plant-chimæras, with plasmic fusion and growing point in common, with ready separation of the two constituents (cf. *Cytisus Adami* and *Solanum tubingense*; Winkler, 1908; Berichte, p. 595). But even in these most intimate dualities, the whole point is that there is *no* new factor introduced, either morphological or physiological, beyond a perfect blend of pre-existing somatic factors, which may separate out without being affected in the least in the 'reverted' branches. It should be interesting to examine the organization of the consortia, and reduce them to simpler factors. A dual organization, if implying a dual control, is, in fact, a biological futility, as a house divided against itself, and hence doomed to rapid extinction. Lichens grow and thrive, within their own limitations, and have done so for indefinite hundreds of millions of years, the time-factor in all such phenomena appearing incredible. The chances are against dual control, quite apart from the fact that the obvious tendency of all biological evolution, both in zoology and botany, has been to establish all successful organism with united control, as expressed ultimately in a central nervous system and the life of the individual. On the other hand, mutual advantage may be more clearly expressed as *mutual dependence*; and in this sense the fungus is interpreted as being *dependent* on the alga only for diffusible carbohydrate; while the alga is often supposed to take salts and water from the substratum *viâ* the hyphæ of the fungus [1]—apparently on the assumption that being wholly enclosed within the mycelium it could not get them otherwise. That the alga acquires a certain amount of shelter from extreme insolation, or from sudden desiccation, may be admitted; but it is quite unjustifiable to suppose that in the general case it is possible to get anything from a living fungus (!), the primary attack of which is undoubtedly quite as much the indication of a search for water and combined nitrogen, as for the carbohydrate it absorbs parasitically, either by haustorial penetration of the algal cells, observed in a few cases [2], or else by stronger osmotic activity [3]. Rhizoids of benthic algæ, or rhizines of lichens, are feeble absorptive and conductive organs at the best for their own thallus. The alga lives, as in the free state, entirely on what it can get from atmospheric precipitations and their swamping effect on the substratum; but it gains from the disintegation of adjacent dead fungus-hyphæ and their residual contents, thus establishing a certain amount of cyclic rotation in the scanty supply of nitrogen and phosphoros compounds.

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[1] A. L. Smith, *Monograph of the British Lichens* (1918). Crombie, *Monograph of British Lichens* (1894). Krempelhuber, *Lichenologie* (*Geschichte und Litteratur*) (1867).

[2] Reinke, Jahrbücher Wiss. Bot. Prings. pp. 39–70 (1895).

[3] Lumière, *Le Mythe de Symbiotes* (1919). Bernard, Ann. Sci. Nat. 9 Sér. ix. 1, L'Évolution dans la Symbiose (1904).

[4] A. L. Smith, *op. cit.* p. x. West, *Algæ*, i. p. 141 (1916).

[5] West, *loc. cit.* Acton, Ann. Bot. xxiii. p. 579 (1909): "*Botrydina vulgaris*, a 'primitive Lichen.'"

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[1] *Cf.* Bonnier, Ann. Sci. Nat. Sér. 7, ix. p. 29 (1889), for the germination of the spores of *Physcia* on *Vaucheria*, with failure to produce symbiotic union, as 'no false tissues.'

[2] Cotton, Brit. Myc. Soc. Trans. iii. p. 92 (1909), for 9 species of Pyrenomycetes parasitic in marine Algæ: *Mycosphærella* of *Pelvetia* and *Ascophyllum*.

[3] The process of fertilization (spermatogamy) involving a 'trichogyne' is left for further discussion.

[4] Much the same applies to the so-called Basidiomycete Lichens (cf. *Cora*, in which there is very little special 'soma' that can be called a consortium). Old Polypori, growing on trees in this country, commonly become bright green on the upper surface with encrusted *Pleurococcus*, and section shows that green algal pockets may be 'intrusive' to a depth of 100 μ or more, as a 'gonidial' zone, without being regarded as forming a lichen consortium. It is evident that the phenomenon may exist in all grades of 'intrusion' and 'parasitism.'

It is interesting to compare the accounts of accepted text-books on the subject. An obsession for looking at everything in Botany through Continental spectacles has admittedly characterized the writers of the last few decades in this country, but the same mental attitude may not appeal to a younger generation. Thus Sachs [4], from the standpoint of a physiologist, describes the Lichen as 'compounded' of an alga and a fungus; and yet clearly states that the algæ are 'imprisoned' by the latter, heading the page '*commensalism*.' On the other hand, though he sees the problem of the 'form' of the complex—as the symbionts assume forms "otherwise proper only to typical chlorophyll-containing plants,"—he does not discuss it further; the conclusion that the "restrictive significance of the chlorophyll for the whole configuration of the vegetable world at once makes itself prominent again," being really in the best style of his despised Nature-Philosophers. On the other hand, West[1], as a modern algologist, sees clearly the deterioration of the algal constituent, where this has anything that might be called a somatic factor, and the degradation so far as this component is concerned. Hence he discards the idea of 'symbiotic commensalism' in favour of an obvious condition of '*helotism*' on the part of the alga; the fungus being clearly dominant, and the control so far unified, as in the cases of the Green Hydra and the fresh-water *Spongilla* with intrusive *Chlorella*, which cannot be said to present much indication of the 'restrictive significance' of chlorophyll. Yet this does not touch the real point at issue; since, while the latter animals retain their respective complex natural morphology entirely unaffected, the Lichen-symbiosis gives what is apparently a wholly new growth-form, 'previously wanting to either constituent.' Thus Schenck (in Strasburger's text-book) even goes so far as to state that the numerous lichenic acids are products of metabolism peculiar to the group, and that their production is due to the "mutual chemical influence" of the alga and the fungus—a wholly gratuitous conception when it is remembered that chrysophanic acid (parietin), one of the best known, is widely distributed, and occurs in relatively enormous quantities in the rhizome etc. of *Rheum*.

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[1] Strasburger, *op. cit.*

[2] Bornet, Ann. Sci. Nat. xvii. 54 (1873).

[3] Paulson in Journ. Linn. Soc. (Bot.) xliv. 503 (1920).

[4] Sachs, *Physiology*, Engl. Trans. p. 393 (1887).

The attitude of Sachs is further emphasized by Goebel[2], who implies that the conception of a primary lichen-thallus is necessarily '*dorsiventral*,' since unavoidably following the organization of a 'leaf-mechanism.' He further expresses the remarkable deduction that all radial organization of a lichen-thallus must be hence wholly secondary in origin and have been evolved from dorsiventral structure in one of three different ways; though the application of these principles to the case of the fruticose *Usnea* is wholly unconvincing. The beautiful thallus of *Cladonia verticillata* (loc. cit. p. 72) is put forward, from its distant resemblance (on paper) to a coticated *Chara*, as illustrating how from the most different standpoints a similar morphological expression may be attained—an ingeniously perverted view of homoplasy. One thus gets a general idea that in a dorsiventral Lichen a photosynthetic lamina acquires these properties in the same way as does the dorsiventral lamina of the leaf of a higher land-plant (Sachs)—the obvious conclusion of a botanist of land-flora alone,—but this only begs the question; the point still remains as to how the land-plant itself ever came to attain such a space-form and organization. Even the building of an elongated centric axis of growing hyphæ is clearly an extremely elaborate process, for which one has to enquire (1) the conditions of the environment to which it is the response, (2) the factors involved in working it out, and (3) the mechanism by which such factors may be inherited. The merest weft of hyphal mycelium is in itself a construction of indefinite complexity (as also antiquity); once it is grasped that the ordinary filamentous mycelium of a heterotrophic Fungus can be only attained *viâ* a period of autotrophic filamentous and probably massive marine phytobenthon, itself in turn the highly elaborated adaptation of a plankton life-history. The idea begins to emerge that the physiological resemblance in functional organization between a lichen-thallus and a leaf-lamina represents a phenomenon of convergence in widely divergent series of the plant-kingdom, which only meet in their common ancestry in the sea; and the point arises as to what factors they may have had in common at that epoch. Sachs as the typical land-botanist takes the land-plant for granted, as if one could not possibly make an autotrophic organism of the land in any other way.

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[1] West, *Algæ*, i. p. 37 (1916).

[2] Goebel, *Organography*, Engl. Trans. i. p. 71 (1900).

On the other hand, after eliminating all that can be said with regard to (1) the Holoparasitism of the Fungus; (2) the Helotism of the alga in the protective and secluded recesses of the fungus-mycelium; (3) the direct analogy of such a 'dual' organism to the phenomena of 'intrusion' presented by the case of the Green Hydra, the Radiolarian with its Zooxanthellæ, or the green fresh-water sponge (*Spongilla*), as also the story of the decadence of the green marine worm, *Convoluta*, there yet remains a residual factor, which is the one covered by the term 'consortium,' as the undoubted fact that the mycelium of the Fungus concerned, beginning ontogenetically as a structureless weft, does produce a soma with distinctive form-factors, readily identified by collectors, in terms of thalloid shoots of differentiated appearance, symmetry, texture, and ramification, which constitute the '*Lichen-Plant*,' as a distinct type of vegetation demanding analysis and explanation. It is in such definite form-factors that the special interest of the group now centres. In other words, the discussion of the Lichen resolves itself into: (1) the story of the dominant Fungus; (2) the story of the Alga in a condition of 'beneficent slavery'; (3) the story of something which is possibly neither, but apparently new, and commonly accepted as a 'consequence of the symbiosis.'

One looks in vain among the writings of Lichenologists for any adequate appreciation, analysis, or even in most cases intelligible description of the form-factors of a Lichen; and yet it should be sufficiently clear that if these have arisen *de novo*, since the subaerial symbiosis began, they must have a most significant bearing on the manner in which physiologically specialized somata may be put together. Each individual factor requires to be isolated, scheduled, and accounted for at its exact biological value, as solving some particular and insistent problem of the two symbionts, which should be within recall. All Lichens are admittedly vegetation of the land, and adapted to one general set of subaerial conditions, involving moisture, free oxygen, and light-supply, with some source of food-salts. No more delightful study could be offered a Lichenologist than the building-up of the history of the progressive attainment of a wholly new somatic organization, step by step, from the earliest syntheses. The details of some such syntheses, with very beautiful figures, are given by Bonnier (1889) for *Physcia*, but they stop just as they begin to become interesting. Beyond older bare generalizations as to *fruticose*, *crustaceous*, *gelatinous*, etc., forms, the *homiomerous* and *heteromerous* types of Wallroth (1825), and the *radial* as opposed to *dorsiventral* of Goebel (1900), one gets little from a text-book of Lichens beyond a mass of particularly elegant but vague terminology (Crombie, 1894, p. 1).

(To be continued.)

ALABASTRA DIVERSA.—PART XXXIII[*].

By Spencer Le M. Moore, B.Sc., F.L.S.

(Continued from p. 195.)

3. Miscellanea Africana.

Erythroxylaceæ.

Nectaropetalum congolense, sp. nov. Arbor 25-metralis superne breviter ramosus; *ramulis* subteretibus cinereo-corticatis foliosis glabris juvenilibus ramentis arcte approximatis onustis; *foliis* brevipetiolatis ovato-oblongis obtusis breviterve acuminatis basi obtusis integris pergamaceis glabris costis lateralibus utrinque 8–12 paullo ultra medium dichotomis haud bene aspectabilibus; *stipulis* cymbiformibus obtusis vel acutis cito evanidis; *floribus* in cymas pro inflorescentia perpaucas breves paucifloras ex axillis ramentorum ortas ordinatis; *pedicellis* floribus subæquilongis; *calycis* segmentis triangularibus obtuse acutis; *petalis* calyce paullo longioribus breviter unguiculatis oblongo-obovatis obtusissimis juxta basin nectario brevi integro onustis; *filamentis* ima basi connatis superne angustatis; *ovario* anguste oblongo-ovoideo 2-loculari; *stylo* perbrevi stigmate majusculo peltato-bilobulato terminato; *ovulis* quove in loculo solitariis uno solummodo maturante.

Mayumbe, river Lufo; *Gossweiler*, 7939. To this belongs 7773 from the Curanda river between the N'Zanga and the Lufo; also 8184 from Belize.

Folia usque 10 × 4·5 cm., sæpius ±7 × 3 cm., pag. sup. nitidula, in sicco fusco-olivacea, subtus pallidiora necnon opaca; petioli 5 mm. long. Inflorescentiæ circa 10 × 7 mm. Pedicelli mox nutantes, 2–3 mm. long. Calyx totus 2 mm., lobi soli 1 mm. long. Petala alba, 3·5 mm. long., unguis solus ·75 mm. Filamenta ima basi leviter dilatata, 2·5–3 mm. long., antheræ suborbiculares, fere 1 mm. diam. Ovarium 1·75 mm. long.; stylus modo ·2 mm. long.; stigma ·8 × 1·2 mm. Fructus verisimiliter drupaceus hucusque valde crudus, oblongus, 5 mm. long.

With its nearly sessile quasi-peltate stigma this might perhaps be regarded as the type of an undescribed genus, particularly as the fruit of *Nectaropetalum* is unknown; but the stigma is plainly dimerous, and as for the shortness of the style, the flowers may be heterostylous, which is frequently the case with the Erythroxylons, although a long-styled flower was not seen among the many examined. Stapf (Hook. Ic. Plant. sub tab. 2840) suggests the removal of *Nectaropetalum* from *Linaceæ*, which Engler thought its true position, to *Erythroxylaceæ*, a suggestion borne out by the presence of the ramenta so characteristic of *Erythroxylon* on the young branches of *N. congolense*. Up till the present time the genus has comprised four species, two each from East and South Africa, so that its occurrence in West Africa marks a notable enlargement in the distribution.

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[*] Types in the National Herbarium.

Umbellulanthus, genus novum. *Sepala* 5, libera, integra. *Petala* 5, hypogyna, æstivatione imbricata, sepalis plane longiora, unguiculata, patentia, basi inappendiculata. *Stamina* 10, filamentis inter sese æquialtis ima basi connatis; antheræ ovatæ, inappendiculatæ, loculis longitrorsum dehiscentibus. *Ovarium* 3-loculare, ovulis pro loculi 1, pendulis. *Styli* 3, a basi distincti; stigmata simplicia.—*Frutex* scandens, fere glaber. *Folia* opposita, petiolata, integra, glandulis translucentibus prædita. *Stipulæ* verisimiliter binæ, minimæ, fugaceæ. *Flores* parvi, in paniculas pedunculatas axillares vel terminales bracteatas ex umbellis paucifloris basi squamulis parvulis stipatis compositas digesti. Fructus ignotus.

Umbellulanthus floribundus, sp. unica. Planta *ramulis* subteretibus sat crebro foliosis leviter scabriusculis; *foliis* ovato-oblongis breviter acuminatis apice acutis basi obtusis membranaceis utrobique fere glabris; *paniculis* foliis sæpe subæquilongis; *pedunculis* uti pedicelli gracillimis scabriusculis; *pedicellis* flores longe excedentibus; *sepalis* ovatis obtusis petalis 5-plo brevioribus; *petalis* oblongo-spathulatis obtusis margine crispulis; *ovario* subgloboso glabro; *stylis* ovario certe longioribus compressis glabris.

Mayumbe, Buco Zau; *Gossweiler*, 7227.

Folia usque 11·5 × 4·5 cm., sæpius ± 8 × 3·5 cm., summa in bracteas transeuntia, pag. inf. pallidiora; petioli 5–10 mm. long., canaliculati. Paniculæ laterales circa 6 cm., terminalis fere 10 cm. long.; harum bracteæ foliaceæ, 1–1·5 cm. long. Pedunculus 5–40 mm. long.; pedunculi partiales ± 5 mm. long. Pedicelli filiformes, ± 7 mm. long. Sepala 1 mm., petala 5 mm. long., hi dilute viridia. Filamenta 2 mm., antheræ 1·5 mm. long. Ovarium 1 mm. long., styli 3 mm.

This curious plant diverges from *Erythroxylon* in having no appendage to the petals, but the æstivation and the stamens point to its inclusion in this group rather than in *Linaceæ* proper. The opposite leaves indicate affinity with *Aneulophus*, which has sessile axillary inflorescences, with each pedicel bearing 4 scales at the base of its flower; in addition each cell of the ovary has 2 ovules.

The stipules were made out only with great difficulty; there seem to be two of them on each side between the pairs of leaves, very small (not more than 1 mm. long) and apparently very fugacious.

In one flower dissected there were but two styles, one very thick and evidently formed of two coalesced, and in this case the ovary appeared to be bilocular; but this was evidently an abnormality.

ICACINACEÆ.

Monocephalium, genus novum. Flores feminei solum cogniti. *Sepala* 4, libera, æstivatione valvata. *Petala* 0. *Andræcii vestigia* 0. *Ovarium* omnino liberum, appresse villosum, 1-loculare, in stylum crassum exiens. *Stigmata* plura, crassiuscula. *Ovula* 2 ab apice loculi pendula, arcte approximata. *Fructus* 1-spermus, velutinus, endocarpio spinis validis longiusculis endospermum pungentibus onusto.—Plantæ verisimiliter scandentes. Ramuli crebro foliosi. Folia alterna, brevipetiolata. Flores parvuli, in glomerulos sphæroideos axillares plerumque solitarios densifloros dispositi.

Monocephalium Batesii, sp. nov. *Ramis* subteretibus, ferrugineo-velutinis demum glabrescentibus; *foliis* ovato-oblongis breviter acuminatis apice mucronatis basi obtusis margine denticulato-undulatis pergamaceis supra costis pilis appressis onustis exceptis glabris subtus scabriuscule puberulis; *florum* glomerulis quam petioli paullo brevioribus plurifloris; *bracteis* a calyce superatis subulatis velutinis; *sepalis* inter se sæpe inæqualibus erectis oblongis vel anguste oblongo-obovatis obtusiusculis extus velutinis; *ovario* calyce paullo breviore late ovoideo; *stigmatibus* circiter 12 teretibus; *fructibus* pro glomerulo paucis subsphæroideis apice brevissime umbonatis ferrugineo-velutinis.

Cameroons, Bitye, mixed growth on abandoned ground; *Bates*, 1277.

Folia sub lente punctis pellucidis minutissimis prædita, 10–13 × 4·5 – 5·5 cm., in sicco viridi-griseola, subtus pallidiora ibique prominenter reticulata; petioli validi, superne anguste canaliculati, velutini, 6–10 mm. long. Florum glomeruli 6 mm. diam.; horum pedunculus validus, velutinus, vix 2 mm. long. Bracteæ circa 1 mm. long. Sepala usque 3 mm. long. Ovarium cum stylo 2 mm. long. (incluso indumento), 1·5 mm. diam. Stylus ovario continuus pariterque villosus, ·5 mm. long. Fructus 12 × 10 mm.

Monocephalium Zenkeri, sp. nov. A præcedenti abhorret præsertim ob *folia* minora; *glomerulos* paullo minores, sæpe pro axilla 2 vel etiam plura, pedunculis usque 3 mm. long. insidentes; *flores* minores, necnon ovarium minus in stylum breviorem desinens; *stigmataque* brevissima.

Cameroons, Bipinde; *Zenker*, 4904.

Folia 6–10 × 2–4 cm. Glomeruli 5 mm. diam. Sepala usque 2 mm. long. Ovarium cum stylo 1·75 mm., stylus solus ·25 mm. long. Fructus haud suppetunt.

The floral structure of this genus is that of *Pyrenacantha*, but in its glomerate flowers it resembles *Polycephalium*, the female flowers of which, however, have a corolla.

Stachyanthus nigeriensis, sp. nov. Planta scandens?, *ramis* validis subteretibus striatis lenticelliferisque sparsim foliosis; *foliis* pro rata longe petiolatis ovatis cuspidato-acuminatis apice obtusis basi rotundatis tenuiter coriaceis pag. utravis leviter nitidis tenuiter coriaceis glabris costis lateralibus utrinque 5 apertissime arcuatis pag. inf. eminentibus reticulo sublaxo utrobique optime visibili; *spicis* foliis multo longioribus ex ramis defoliatis (anne ex trunco?) ortis erectis puberulis; *bracteis* minimis subulatis puberulis; *calyce* campanulato 6-denticulato fere glabro; *corolla* hexamera cylindrica diutule gamopetala sparsissime puberula; *staminibus* 6 antheris sagittatis obtusis quam filamenta longioribus; *rudimento* ♀ bene evoluto antheris ægre æquilongo.

South Nigeria, Oban; *Talbot*, sine no.

Ramus albo-corticatus, 4 mm. diam. Folia 10–13 × 6–6·7 cm., margine paullo revoluta; petioli 3 cm. long. Spica 28·5 cm. long.; hujus axis inferne 2 mm., superne 1–·5 mm. crass.; pars florifera verisimiliter 10 cm. long., exemplarii unici nobis obvii ob flores delapsos modo 3 cm. Bracteæ ·65 mm. long. Calyx 1 mm. alt., 2·5 mm. diam. Corolla saltem in sicco fusca, 5 mm. long. Filamenta 1·3 mm., antheræ fere 3 mm. long. Rudimentum ♀ oblongo-ovoideum, sursum attenuatum, apice obtusum, 2·75 mm. long.

Distinguished easily from *S. Zenkeri* Engl. by the leaves, the long spikes, ampler nearly glabrous calyx, stamens with shorter filaments and longer anthers and larger rudimentary gynœcium. The hexamerous flowers were at first thought to be another point of difference; but examination of Zenker 1093, on which the genus was founded, proves Engler to have been wrong in describing the flowers as pentamerous, for both species have a 6-denticulate calyx, 6 petals and 6 stamens.

Stachyanthus obovatus, sp. nov. Planta scandens, *ramis* subteretibus foliosis pilis hispidis præditis tandem glabris; *foliis* brevipetiolatis obovatis rarius obovato-oblongis cuspidato-acuminatis apice obtusis basi breviter cordatis membranaceis supra glabris nitidulisque subtus pilis hispidis appressis secus nervos obsitis; *spicis* solitariis vel fasciculatis ex trunco oriundis foliis brevioribus scabriuscule puberulis; *bracteis* parvulis subulatis; *floribus* ♂ calyce pro rata ample campanulato 6-denticulato uti petala scabriusculo petalis oblongis acutiusculis filamentis quam antheræ paullo longioribus rudimento ♀ sursum inflexo fere glabro; *floribus* ♀ calyce quam is maris paullo majori inæqualiter 6-denticulato petalis 6 (duobus tandem primo sæpe alte connatis) disco 0 ovario oblongo (cito ovoideo) breviter villoso 1-loculari stigmate magno sessili integro coronato ovulis 2 ab apice loculi pendulis fructu verisimiliter monospermo exocarpio coriaceo endocarpio pustulis magnis obtusis obtecto.

Mayumbe, in shady woods at Buco Zau; *Gossweiler*, 6825 (♂), 6626 (♀).

Folia pleraque 12–16 cm. long., 5·5–8·5 cm. lat., in sicco læte viridia; costæ et reticulum ut in *S. Zenkeri* Engl.; petioli 5–10 mm. long., hispidi. Spicæ usque 11 cm. long., sæpissime ±7 cm. Bracteæ 1·5–2 mm. long. Calyx ♂ 2 mm., ♀ 2·5 mm. diam. Petala 4 mm. long. Filamenta 2·25 mm., antheræ oblongæ, obtusæ, 2 mm. long. Ovarium florendi temp. 3 mm. long.; stigma circa 1 mm. diam. Fructus (anne maturus?) compressus, pubescens, 2 × 1·5 cm.

Gossweiler's 6521, also from Buco Zau, is evidently the same thing with still larger leaves (up to 20 × 10 cm.

Differs from *S. Zenkeri* Engl., which it closely resembles externally, in the broader leaves wider at the base, the more conspicuous calyx, the longer filaments and the bent nearly glabrous rudiment of the ovary. Difference in the ♀ flower, if any, cannot be stated until the ♀ plant of *S. Zenkeri* comes to light.

Pyrenacantha sylvestris, sp. nov. Planta scandens, *caule* volubili prima juventute ferrugineo- vel brunneo-velutino deinde glabrescente; *foliis* petiolatis oblongo-obovatis obovatisve nonnunquam levissime subpanduriformibus acutis nisi acuminatis basi obtusis primo margine denticulatis dein summum undulatis nisi denticulis perpaucis obscurissimis prædítis pergamaceis supra cito glabris pallideque nitidis subtus strigilloso-pubescentibus costis lateralibus utrinque 4–5 vix arcuatis prope marginem dichotomis una cum reticulo laxo pag. inf. optime eminentibus; *inflorescentiis* ♂ et ♀ fasciculatis (his rarius solitariis) sat elongatis laxifloris pubescentibus illis gracillimis; *floribus* ♂ pedicellatis; *perianthii* phyllis oblongis obtusis; *antheris* parvulis subsessilibus; *floribus* ♀ pedicellatis; *perianthii* phyllis ♂ similibus nisi majoribus; *ovario* anguste ovoideo brunneo-velutino in stylum perbrevem desinente; *stigmatibus* pluribus brevissimis; *ovulis* 2 altero subobsoleto; *bacca* ovoidea brunneo-velutina stylo persistente coronata.

Mayumbe, abundant in shady woods at Buco Zau; *Gossweiler*, 6811.

Folia 17·5 × 8 cm. attingentia, pleraque vero ±12 × 6 cm., nonnunquam adusque 7 × 4 cm. redacta, supra in sicco olivacea subtus pallidiora; petioli validi, 1·5–3·5 cm. long., sæpe torti, velutini. Inflorescentiæ ♂ 4–7 cm. long.; bracteæ ·5 mm., pedicelli 1–1·5 mm., perianthii phylla 2 mm., antheræ ·3 mm. long. Inflorescentiæ ♀ 3–4 tandem usque 6 cm. long.; bractea 2 mm., ovarium 4 mm., stylus ·5 mm. long. Bacca 12 × 8–10 mm.; endocarpium album, extus scrobiculatum, intus valide spinosum.

A very distant species. The material under the above number consists of ♂ and fruiting specimens: under 6901 from the same locality are sent ♀ in flower, which have been used in the description.

RHAPHIOSTYLES FERRUGINEA Engl. var. PARVIFOLIA, var. nov. A typo distat ob folia minora (4·5–6 × 1·8–2·5 cm.) petalaque longiora (9 mm. long.) extus ferruginea. Maiumbe, Belize; *Gossweiler*, 6990.

OLACACEÆ.

Strombosia retevenia, sp. nov. Arbor? glabra, *ramulis* teretibus crebro foliosis; *foliis* obovato-oblongis breviter acuminatis apice obtusis basi in petiolum cuneatim coartatis pergamaceis pag. utravis pallide nitidis costis lateralibus utrinque sæpissime 5 parum arcuatis costulis optime visibilibus inter se 1·5–3 mm. distantibus sæpe dichotomis et adjuvantibus aliis tenuioribus reticulum perspicuum referentibus; *fasciculis* axillaribus vel ex-axillaribus paucifloris squamelliferis; *floribus* subsessilibus; *alabastris* ovoideis; *calycis* dentibus brevibus rotundatis; petalis anguste ovato-oblongis acutis; *filamentis* juxta basin petalis insertis complanatis crassiusculis antheris ob connectivum expansum late ovatis; *ovario* ovoideo disco crasso valde prominente abscondito; *stylo* incrassato punctis 5 stigmatosis prædito; *ovulis* 5.

S. Nigeria, Oban; *Talbot*, 1465.

Folia 15–20 × 5·5–8·5 cm., in sicco griseo-viridia; petioli ±1·5 cm. long., superne incrassati. Pedicelli crassi, 1 mm. long. Calyx ·75 mm., petala 2·5 mm. long. Antheræ 1 × 1 mm. Discus 1 mm. alt. Stylus ex disco ·75 mm. eminens.

Differs from *S. grandifolia* Hook. f. entirely in the flowers, as well as in the nervation of the leaves.

Strombosia majuscula, sp. nov. Arbor glabra, ramulis teretibus leviter anfractuosis cortice brunneo circumdatis foliosis; *foliis* magnis brevipetiolatis anguste ovato-oblongis basi obtusis pergamaceis leviter nitidis costis lateralibus utrinque 7–8 subtus optime eminentibus costulis utrobique bene visibilibus inter se 3–6 mm. distantibus; *fasciculis* axillaribus vel ex-axillaribus paucifloris squamellis minimis stipatis; *floribus* subsessilibus; alabastris obovoideo-cylindricis obtusissimis; *calycis* ore breviter 5-denticulato; *petalis* anguste oblongo-ovatis obtusis crassiusculis; *antheris* sessilibus basin versus petalis insertis; *disco* parum prominulo; *ovario* disco ½-immerso in stylum oblongo-conoideum crassum apice punctis 5 stigmatosis donatum desinente; *ovulis* 5.

Portuguese Congo, Hombe region, banks of river Lufo; *Gossweiler*, 7720.

Arbor 15 m. alt. Folia 25–30 × 7–9 cm.; in sicco griseo-viridia; petioli validi, sub limbo tumidi necnon fusci, 2–2·3 cm. long. Pedicelli crassi, ægre 1 mm. long. Alabastra 5 mm. long. Calyx vivus viridis, 1·5 mm. long. Petala aurea, 5 mm. long. Antheræ ovato-oblongæ, apice obtusissimæ vel bifidæ, connectivo lato instructæ, fere 3 mm. long. Ovarium 1 mm. stylus 3·5 mm. long. Fructus obovoideus, juxta medium reliquiis calycis fere evanidis notatus, 19 × 17 mm.

To be inserted in the genus next *S. Scheffleri* Engl. from which it can be at once told by the larger leaves with wider intervals between the nervules and the larger subsessile flowers.

Strombosia toroensis, sp. nov. Arbor glabra; *ramis* dependentibus; *ramulis* subteretibus bene foliosis; foliis petiolatis ovatis apice—basi obtusis pergamaceis supra pallide nitidis costis lateralibus utrinque 5–6 costulis inter se 2–3 mm. distantibus difficile aspectabilibus; *fasciculis* axillaribus vel ex-axillaribus plurifloris squamelliferis; *floribus* pro rata majusculis pedicellatis; *alabastris* late cylindricis; *calyce* minuto obtuse dentato; *petalis* oblongis obtusis intus superne necnon marginibus albo-villosulis; *staminibus* petalis apicem versus insertis antheris oblongis obtusis; *disco* inconspicuo; *ovario* ovoideo longitrorsum sulcato in stylum æquilongum desinente; *ovulis* 3.

Toro, Mpanga forest; *Bagshawe*, 1098.

Folia pleraque 10–15 × 6–9·5 cm., in sicco viridi-grisea; petioli crassiusculi, ± 2 cm. long., 2 mm. lat. Pedicelli 3–3·5 mm. long. Calyx ·35 mm. long. Petala 5·5 × 1·5 mm. Antheræ 1·2 mm. long. Ovarium 2 mm., stylus 2 mm. long.

The relatively large flowers enable one at a glance to tell this from *S. Scheffleri* Engl.

To this is referred a Portuguese Congo plant (*Gossweiler*, 7377) with larger leaves (up to 20 × 13 cm.) and somewhat smaller flowers on pedicels which may reach 4 mm. in length. The petals are rather shorter (5 mm.) and narrower than those of the type and are also less hairy. A Gazaland plant (*Swynnerton*, sine no.) also belongs here.

Strombosia Gossweileri, sp. nov. Arbor glabra, 25 m. alt.; *ramulis* ultimis gracilibus ancepitibus bene foliosis; *foliis* oblongo-ellipticis superne caudato-acuminatis apice obtusis basi in petiolum brevem cuneatim angustatis pag. utravis pallide nitidis papyraceis costis lateralibus utrinque 4–5 superioribus valde inferioribus paullo arcuatis costulis parum aspectabilibus; *fasciculis* axillaribus vel ex-axillaribus paucifloris basi squamelliferis; *floribus* parvulis breviter valideque pedicellatis; *alabastris* anguste ovoideis; *calycis* lobis triangularibus crassiusculis; *petalis* ovato-oblongis obtusis; *filamentis* juxta medium petalis affixis antheris subquadratis; *disco* valde prominente ovarium obtegente; *stylo* quam petala plane breviore; *ovulis* 3 *fructu* ovoideo 1-spermo exocarpio in sicco cinereo pustulatoque.

Mayumbe, common in shady humid woods at Belize; *Gossweiler*, 7007.

Folia pleraque 12–17 × 4–5·5 cm., in sicco griseo-viridia, costa media costæque laterales pag. inf. prominentes; petioli ± 1 cm. long., superne incrassati. Calyx ·4 mm., petala 2 mm., antheræ ·25 mm. long. Ovarium ·8 mm., stylus ·4 mm. long. Fructus 16 × 12 mm.; semen 12 × 8 mm., in sicco rugulosum.

Easily distinguished from *S. Zenkeri* Engl. by the two-edged branchlets of the larger caudate-acuminate leaves. Though without mature flowers, No. 7648 from the same place is evidently conspecific.

Following Engler in his clavis of *Strombosia* (Bot. Jahrb. xliii. 165), an arrangement sufficiently good to answer temporarily, the genus as now known may be exhibited as follows:—

- Leaves more or less shining.
  - Nervules connecting the side-nerves prominent.
    - Nervules forming a network .... *S. retevenia*, sp. n.
    - Nervules running straight or almost so.
      - Nervules close together .... *S. grandifolia* Hook. f.
      - Nervules subdistant.
        - Leaves 15–20 cm. long. Flowers 3 mm., pedicels 3 mm. long... *S. Scheffleri* Engl.
        - Leaves 25–30 cm. long. Flowers 5 mm., pedicels 1 mm. long... *S. majuscula*, sp. n.
        - Leaves 10–15 (20) cm. long. Flowers 5–5·5 mm., pedicels 3–3·5 mm. long.................. *S. toroensis*, sp. n.
  - Nervules connecting the side-nerves obscure.
    - Leaves strongly coriaceous .... *S. Mannii* Engl.
    - Leaves papery.
      - Branchlets terete. Leaves shortly acuminate .... *S. Zenkeri* Engl.
      - Branchlets two-edged. Leaves caudate-acuminate .... *S. Gossweileri*, sp. n.
- Leaves opaque.
  - Leaves flat, mucronate, closely pustular beneath .... *S. pustulata* Oliv.
  - Leaves flat, obtuse, slightly pustular beneath. *S. glaucescens* Engl.
  - Leaves complicate, not pustular .... *S. minor* Engl.

Strombosiopsis buxifolia, sp. nov. Arbor 10–15 m. alt., *ramulis* ultimis sat gracilibus crebro foliosis fusco-velutinis dein glabrescentibus; *foliis* pro rata parvis subsessilibus ovato-oblongis apice emarginatis basi obliquis cuneatimque angustatis pergamaceis glabris costa media supra impressa subtus eminente costis lateralibus difficile visis; *floribus* subsessilibus axillaribus vel extra-axillaribus aliis ex ramulis ortis solitariis vel perpaucis aliis ex ramis jam defoliatis pluribus fasciculatis fasciculis basi squamelliferis; *alabastris* oblongo-ovoideis obtusis; *calycis* dentibus brevibus rotundatis; *petalis* oblongis obtusis glabris; *staminibus* linearibus breviter apiculatis; *bacca* subglobosa apiculata pedicello brevissimo valido insidente matura dilute flava.

Mayumbe, common at Belize; *Gossweiler*, 6972. No. 7138, also from Belize, is conspecific; it has only a few very small buds.

Folia ±4 × 1·5 cm., in sicco griseo-viridia, utrobique microscopice pustulata; petioli summum 2 mm. long. Calyx totus 1·25 mm. long.; dentes ·5 mm. long. Bacca usque 17 × 14 mm., saltem in sicco leviter rugulosa. Semen 11 × 7 mm.

Besides fruit, the specimens bear only very young buds, so that useful floral measurements cannot be given: this is little to be regretted since the very small box-like leaves, entirely unlike those of species hitherto known, serve easily for recognising the plant.

Coula utilis, sp. nov. Arbor 25 m. alt., *ramulis* sat gracilibus cito glabrescentibus innovationibus ferrugineis; *foliis* anguste oblongo-ovatis vel obovato-oblongis petiolis superne incrassatis insidentibus acuminatis apice obtusis basi obtusis leviterve rotundatis papyraceis pallide nitidis glabris costis pag. inf. prominentibus utrinque 8–11 costulis numerosis inter costas fere rectis parum aspectabilibus; *floribus* in paniculas racemosas extra-axillares breves fere glabras digestis; *calyce* parvulo ore undulato; *petalis* triangularibus obtuse acutis leviter crassiusculis; *staminibus* circa 20 filamentis inæquilongis; *ovario* in longitudinem rugoso inferne incomplete 4-loculari 4-ovulato; *stylo* subnullo; *drupa* endocarpio lignoso extus verrucosa 1-sperma.

Common in the Mayumbe country; *Gossweiler*, 6835.

Folia interdum 20 × 7·5 cm. attingentia, sæpius ±14 × 5 cm., in sicco viridi-griseola; petioli circa 2 cm. long. Paniculæ 1–1·5 cm. long. Pedicelli 1·5–2 mm. long. Alabastra (flores profecto evoluti haud visi) 2 mm. long. Calyx ·75 mm., petala 1·75 mm. long. Discus lobulatus. Ovarium 1·25 × 1·25 mm. Drupa (sarcocarpio exempto) 2·5–3 × 3–3·5 cm. Semina circa 1·5 cm. diam.

Established by Baillon nearly sixty years ago, this genus has hitherto remained monotypic. The somewhat differently shaped papery (not coriaceous) leaves, the quickly glabrescent branches, the nearly glabrous inflorescences, and the apparently smaller flowers with subsessile stigma are the chief points about this plant.

Gossweiler notes that the nuts, called "N'Cumano," are greatly appreciated both by Europeans and natives.

(To be continued.)

SHORT NOTES.

Scilla campanulata Ait. The posters issued on the Underground Railway have long attracted attention for their artistic qualities, and those representing wild flowers have been universally admired, not only on this ground, but on account of their scientific accuracy. It was therefore with some surprise that I noted in a recent picture of "Richmond Park" an admirably drawn group of unmistakeable *Scilla campanulata* depicted as growing wild at the foot of the trees, and I called the attention of the railway authorities to the matter. They communicated with the artist, Mr. Tafani, whose agent replies that the plant "actually grew in Richmond Park; after making the sketch he [Mr. Tafani] plucked the flower and took it home to his studio and made a detailed study": the drawing for the poster was thus evidently not made *in situ*. Mr. A. Oliver, the agent in question, whose letter shows that he is not quite *au fait* as to the botanical aspect of the matter, writes: "You are of course aware that there are many varieties of the Bluebell; and I beg to say that I have myself discovered this particular species frequently in the West of England, and on occasions in damp spots in woods in Middlesex." In answer to further inquiry Mr. Oliver wrote: "Concerning the instance which I quoted of my having seen the *Scilla campanulata* growing wild, I have a clear recollection of noticing the plant growing in a very moist and mossy spot in a wood, whilst waiting to shoot wood pigeons. I mention my errand on that occasion, as although it may not be significant I have noted that in each instance of my seeing this plant it was among trees in which wood-pigeons were building, with one exception where it was among willow-trees which were full of starlings' nests. The instance mentioned above occurred off the road between Perranporth and Truro in the county of Cornwall. The willow-trees' locality was a little village called Northolt, in Middlesex; and this is the one case in which the plant was growing not very far from cultivated ground and flower-gardens. I should not have been aware of the variety of this flower had it not been pointed out to me, when I was displaying it to a friend, as a fine specimen of a bluebell, believing it to be *Scilla autumnalis*, as I have barely a nodding acquaintance with botany. I also saw a specimen in some woods not far from Watford in Herts, and in this case the woods were actually infested with wood-pigeons. I believe I can trust my memory sufficiently to say that in each case the flower has been in an isolated group of two or three." A West of England record will be found in Journ. Bot. 1912, 216—near Stoke St. Mary, Somerset, where, in company with the late E. S. Marshall, I found the plant in fair quantity over a small area in a hill copse, associated with *Melissa officinalis* and a dark-red garden form of Columbine.—James Britten.

Monotropa Hypopitys. On July 31st I was pointing out to Mr. C. E. Salmon, who was staying here, a big colony of *Helleborus atroviridis* growing beneath some old beeches between the Wyndcliffe and Tintern, when, to my surprise, I found two small specimens of *Monotropa Hypopitys*, which I had never seen on several previous visits to the spot. It is, I believe, a new record for v.c. 35, not being recorded in Watson's Top. Bot. or in the Supplement. A few days previously Miss Marshall showed it to me growing in fair quantity and very fine under beeches at Offa's Dyke, on the other side of the Wye in v.c. 34. It is not a new record for that vice-county, but I had not until then seen it growing anywhere in this district.—W. A. Shoolbred.

REVIEWS.

On the Interpretation of Phenomena of Phyllotaxis. By A. H. Church, M.A. Oxford, 1920, 58 pp. with 18 figs. 8vo. Botanical Memoirs, No. 6.

This erudite and comprehensive treatise on an abstruse and complicated subject, which Mr. Church has largely made his special pursuit or hobby, deserves the close attention both of the mathematically-inclined biologist and of the botanical mathematician. It is not common to find a scientific man fully competent on each aspect of the study.

In one place, p. 6, the author states: "The great difficulty of phyllotaxis discussions appears to be to steer clear of mathematics and take facts as given by actual plant-forms; since facts of observation may be correct if the interpretation prove wrong." In another place, p. 32, "an angle of approximately 137½° has been termed the Fibonacci angle, in contradistinction to the 'Ideal Angle' of the Schimper-Braun notation; the latter a purely mathematical abstraction, while the former is an established *fact of observation* taken directly from plant-constructions. The value of this angle is so peculiar, that no reasonable person can further refuse to believe that it actually represents an approximation in the plant-organization to the theoretical Ideal Angle (137° 30′ 28·936″) which would afford maximum illumination to the leafy system if vertically displayed; and that this is no mere coincidence, but a phenomenon of such wide occurrence that it must undoubtedly afford some clue to the remarkable problems of short-construction. But such phenomena, as expressed in the constancy of the angle, even if no more accurate than the angle accepted (of about 137½°), require a mechanism for their production; and it is naturally in this mechanism that the whole of the physiological interest of the subject is centred."

As the mere mention of Tangential, Equiangular, or Logarithmic Spirals, which are the curves utilized in the preliminary constructions, is enough to discourage the non-mathematical botanist, the author, in employing the same idea, prefers to sum it up as the *Equipotential Theory of Phyllotaxis.* The characteristic property of the Logarithmic spiral is that the angle between the radius vector and the curve is constantly the same, and on this account it is often termed the Equiangular Spiral. Other properties are that the evolute of the curve is also a Logarithmic Spiral similar to the original one; and that the Involute of the curve is an equal and also similar curve. These properties of the Logarithmic Spiral appeared so remarkable to the eminent Swiss mathematician, James Bernoulli, that he usually denominated it *spira mirabilis*; and in a paper published in the Leipsic Acts in 1692 he concluded his article on this curve with a quaint paragraph, adding the epigraph, *eadem numero mutata resurgo.* He directed that an Equiangular Spiral should be engraved on his tomb, as an image of Immortality.

As to the general principles of phyllotaxis, Mr. Church asserts that modern botany has but little to do merely with the effects which appeal to the eye on an adult plant-shoot. It seeks to determine how these phenomena originated, what is the mechanism of their production, what factors lie behind the mechanism, and how it was originally called into operation; that is to say, for what original function, or by what response to conditions of external environment. A short historical account of earlier writings on the matter is given; and illustrations expressing some of the more important features of construction are produced in the figures.

Numerous examples of phyllotaxis are instanced, including plants belonging to the following thirty-four natural orders of phanerogams: Coniferæ (*Pinus Pinea* L., fig. vi.; *Araucaria excelsa* R. Br., figs. x., xi), Cyperaceæ, Cycadaceæ, Palmæ, Pandanaceæ, Araceæ, Liliaceæ, Fagaceæ, Casuarinaceæ, Nymphæaceæ, Ranunculaceæ, Calycanthaceæ, Berberidaceæ, Papaveraceæ, Crassulaceæ (*Sempervivum calcaratum* Hort., fig. xii.), Rosaceæ, Geraniaceæ, Euphorbiaceæ (*Euphorbia Wulfenii* Hoppe, fig. vii.), Sapindaceæ, Onagraceæ, Myrtaceæ, Passifloraceæ, Cactaceæ, Ficoideæ, Haloragaceæ, Araliaceæ, Oleaceæ, Gentianaceæ, Apocynaceæ, Polemoniaceæ (*Cobæa scandens* Cav., fig. xiv.), Libiatæ, Dipsaceæ (*Dipsacus fullonum* L., fig. viii.), Campanulaceæ, and Compositæ.

Fig. i. exhibits the geometrical construction for uniform centric growth-expansion, showing method of obtaining orthogonally intersecting pairs of log-spirals for any required ratio, symmetrical or asymmetrical, to be used as curve-rules for drawing any required construction as a standard of reference. Fig. xviii. exhibits retardation-effects in the distichous (1+1) system.

A separate chapter deals with Phyllotaxis-phenomena in cryptogams and Thallophyta: Pteridophyta, Bryophyta, and Algæ, including the fossil, *Lepidostrobus* (sp.), fig. xv. Another chapter is devoted to zoological and geological examples, such as, in Foraminifera, *Quinqueloculina vulgaris, Q. seminulum* (fig. xiii.), etc.

The following note (p. 56) is interesting: "Analogies are not wanting in other departments of biology; for example, a man's nose, with distinctly heritable minor details, is derived from the pointed end of the body of a benthic fish; the latter expresses the pointed end of a flagellate, overhanging the primary oral aperture (cytostome), in turn the consequence of a phase of elementary polarity beyond the original surface-tension sphere of aqueous plasma, and so far tracing back to phenomena associated with surface-tension. Yet few would suggest that the nose is modelled in the human embryo, at the present time, solely as a result of surface-tension. As the organism becomes more complex, so the mechanism producing it may be elaborated beyond recognition, or new mechanism may replace the old; such mechanism being not only individual but racial; *i. e.* representing inherited response to conditions possibly no longer effective."

As would be expected in a work published by the Oxford University Press, the format is excellent; the only misprint detected is at the bottom of p. 32, where the genus *Raphia* appears as *Rahia*.

W. P. H.

A Guide to the Identification of our more useful Timbers, being a Manual for the Use of Students of Forestry. By Herbert Stone, Lecturer in Forestry (Wood). Cambridge University Press, 1920, pp. 52, with 3 Plates, wrapper. Price 7*s.* 6*d.* net.

Mr. Stone's purpose is professedly educational, and we fully agree with his opinion that "there is nothing better than a study of the structure of wood" as "a training in observation." For his own students, the descriptions he gives of some forty common woods, and the "frankly empirical" keys for their discrimination, will undoubtedly be of the greatest value. The publication of this booklet, however, even at the exorbitant price of 7*s.* 6*d.* net—which seems to imply that the parents of university students may be expected to pay anything asked for prescribed text-books—implies an appeal to a larger public, and the only suggestion we wish to make for something more in a second issue is on behalf of such students who have not the advantage of Mr. Stone's teaching at Cambridge. We feel inclined to grumble at his list of "our more useful timbers," which does not include Greenheart, Mora, Jarrah, Kauri Pine, or even Canadian Maple and African Mahoganies, when such woods as Box, Evergreen Oak, Red Gum (*Liquidambar*), Pear, and Laburnum, which cannot accurately be termed timbers, are included.

Only indirectly does Mr. Stone admit the extreme difficulty of specific discrimination, when, for instance, under "Spruce" he says nothing as to the great likeness between the woods of other species of *Picea* and that of *P. excelsa.* To read his "Introductory Note," one might imagine that all the structures he describes in the body of the book could be seen with a lens, which is far from being the case. It would be very helpful if in the next edition some description could be given of the preparation of specimens for examination and of such a special form of compound microscope as that which the author gave in his *Timbers of Commerce.* The necessity for a detailed examination of the rays in conifers, which is recognized by the author in his description of *Pinus sylvestris*, makes the scale of magnification, about 50 diameters, in the plates obviously inadequate. As might be expected from such a master of his subject, Mr. Stone's descriptions are admirably full and of indisputable accuracy.

G. S. Boulger.

BOOK-NOTES, NEWS, etc.

Mr. L. H. Bailey sends us the first number of *Gentes Herbarium*—"Occasional Papers on the Kinds of Plants"—published at Ithaca, New York. This issue is devoted to a collection of plants made by Mr. Bailey in several parts of central China in 1917, in the elaboration of which he has had the help of various botanists.

The arrangement is that of Engler and Prantl; the species under each order are placed alphabetically, not according to relationship. Numerous new species, varieties, and forms are figured and described: the species are *Carex chikungana*, *C. kulingana*, *Salix Baileyi* Schneider, *S. chikungensis* Schneider, *Ficus Baileyi* Hutchinson, *Pilea Henryana* Wright, *Rubus kulinganus*, *Lespedeza distincta*, *L. Stottsæ*, *Maackia honanensis*, *Vicia kioshanica*, *L. kulingana*, *Lysimachia argentata*, *L. chikungensis*, *Sabria honania*, *Stachys arrecta*, *Atractylis separata*. In place of the abbreviation "n. comb." two new terms are proposed:—"n. tr. (trans. nov.): new transfer, for the cases in which n. comb. is customarily used: n. st. (st. nov.): new status (*status novus*) to denote the transfer of a plant to another status or standing, as from a variety to a species and the like."

The *Journal of Ecology* for June contains the conclusion of Miss L. S. Gibbs's "Notes on the Plants, Geography, and Fauna of the mountain summit plateaux of Tasmania" and a paper by Mr. Tansley on "The Classification of Vegetation and the Concept of Development."

In view of the interest in British Marsh Orchids, it may be noted that at the meeting of the Linnean Society on May 6 Mr. Edward J. Bedford exhibited a beautiful series of water-colour drawings, which he further illustrated by lantern-slides from photographs of the plants *in situ* and of enlarged views of the lip. Mr. T. A. Dymes showed a series of fruit capsules and remarked on the characters afforded by the fruit and seeds of these variable plants.

The contents of the *Annals of the Royal Botanic Gardens, Peradeniya*, are entirely from the pen of the editor, Mr. T. Petch, who writes on *Saccolabium longifolium* and *S. Wightianum*, and on the *Hypocreaceæ* of Ceylon (with descriptions of many new species) and summarises "Recent Revisions of Ceylon Botany."

The *Journal of the Royal Horticultural Society* (xlv. pts. 2, 3; July) contains an interesting account, with illustrations, of "Oaks at Aldenham," by the Hon. Vicary Gibbs, which is introduced by a violent attack upon botanical terminology and nomenclature. The author seems to assume that by his use of the former "a botanist desires to prevent a zealous, if imperfectly educated, gardener or amateur from understanding his descriptions." As to nomenclature, "it is not merely the changing of names which gives cause for complaint, but also the frightful grammatical blunders and false concords" by which it is disfigured: "I suppose it would be unreasonable to expect from the names an elementary knowledge of Greek and Latin before making use of those languages, but one would think they might submit their name coinage to some school teacher or schoolboy for correction before putting it into circulation." Mr. G. C. Gough has a paper on "Wart Disease of Potatos" (*sic*) (*Synchytrium endobioticum*), but the part as a whole is somewhat lacking in botanical interest. With the *Journal* is issued a circular inviting subscriptions for the Society's "New Pritzel," which, we are glad to learn, "is now well on its way," but for which, in view of the terribly increased cost of living, money is urgently required.

The *Kew Bulletin* (No. 5) contains an interesting "Revision of *Isopyrum* and its nearer Allies" by Messrs. J. R. Drummond and

J. Hutchinson. Beginning with a full and careful account, both literary and botanical, of the genus as hitherto understood, the authors proceed to a discussion of the species: the former is now divided into seven—*Leptopyrum* Reichb., *Enemion* Raf., *Semiaquilegia* Mak., *Souliea* Franch.—to which are added *Asteropyrum* and *Paraquilegia*, here first described; twelve species (one, *I. Dalzielii*, being new) are retained under *Isopyrum*. The paper, which is accompanied by excellent figures, is in every way a model of what such things should be.

In No. 6 of the *Bulletin* Mr. W. B. Turrill continues his contributions to the flora of Macedonia; the present instalment is based chiefly on a collection made by Mr. L. V. Turner in 1917–18 and includes nearly 120 species and varieties recorded for the first time in this series; they were collected chiefly in the neighbourhood of the Rendina Gulf—a new variety (*rigida*) of *Veronica Chamædrys* is described. Mr. Turrill has a note on "Amphichromy in Heather," based upon a plant of *Calluna vulgaris* from Alness, N.B., showing purple and white inflorescences on the same stock, with a reference to Lindman's paper in Bot. Notiser. 1907, in which a similar plant is described and a terminology for flower-colouration, here translated, is proposed. He also records the occurrence near Rudgewick, Sussex, of a striking form of *Cardamine pratensis* which has one-flowered peduncles about 9 centimetres high, quite destitute of cauline leaves or bracts. This was described by Sternberg and Hoppe in 1815 as *C. pratensis* var. *uniflora*, and was collected by H. C. Watson in Braemar in 1844, but, growing as it did among quantities of the ordinary form, "may be looked upon as an unstable mutation or sport." In the same number Mr. Dunn describes and figures a new genus of *Urticaceæ-Procrideæ* which he names *Smithiella*: "the genus is respectfully dedicated to Miss Matilda Smith, and the specific name [*myriantha*] not inappropriately refers to its innumerable flowers as well as to the very large number of beautiful drawings and paintings of flowers with which Miss Smith has for so many years decorated the *Botanical Magazine*, the *Icones Plantarum*, and the *Kew Bulletin*."

The *Annals of Botany* for July contains a continuation of "Studies on the Chloroplasts of Desmids" by Dr. Nellie Carter: a paper by Dr. H. S. Holden, "On the Anatomy of some Typical Seedlings of *Impatiens Roylei* Walp." [=*I. glandulifera* Royle]; Dr. Bottomley writes on "The Growth of *Lemna* Plants in Mineral Solutions and in their Natural Medium," and on "The Effects of Organic Matter on the Growth of various Water Plants in Culture Solution"; Mr. F. T. Maclean discusses "The Carbon Dioxide Absorption of Coco-nut Leaves"; Dr. J. F. Dastur writes on "The Mode of Infection by Smut in Sugar-cane" and on "*Choanephora cucurbitarum* Thaxter on Chillies"; Dr. F. J. Lewis and G. M. Tuttle have a paper on "Osmotic Properties of some Plant Cells at Low Temperature"; and Mr. V. H. Blackman has a note on "Radioactivity and Normal Physiological Function."

We note with great regret the death, in his 87th year, of Mr. John Gilbert Baker, which occurred at his residence at Kew on the 16th of last month. We hope to publish in an early number a full tribute to his memory.

"JOURNAL OF BOTANY" REPRINTS.

In view of the fact that the stock of these is in some cases practically exhausted, the attention of our readers is directed to the list which appears on the following page. Old subscribers of course already possess the matter contained in them in the pages of the *Journal*; but some of them appeared several years ago, and recent subscribers will thus not possess them. Some, which do not appear in the list, are already out of print; of others very few copies remain, and it will of course be impossible to reprint them: among the latter may be mentioned Mr. Dallman's *Notes on the Flora of Denbighshire* (1911), and Mr. Bennett's *Supplement to 'Topographical Botany.'* Of the Supplements to the *Biographical Index* no complete sets remain. It had been hoped before this to issue the second edition of the work, in which these Supplements are of course incorporated, but the present cost of paper and labour has rendered this impossible. Of the *Index* itself no copies remain, these having been lost in the course of transferring the stock to Messrs. Adlard. Mr. Garry's *Notes on the Drawings of Sowerby's 'English Botany,'* containing, as it does, much topographical information and numerous unpublished notes by Smith, Sowerby and others, should be in the possession of all interested in the history of British Botany: only sixteen copies remain.

It may be pointed out that, although for the most part relating to British Botany, certain of the reprints have a more general appeal. Such are the *Index Abecedarius*—a list of the plants in the first edition of Linnæus's *Species Plantarum*, showing at a glance what are included in that work, which has no index of species; the *History of Aiton's 'Hortus Kewensis,'* which contains much information as to the authors and contents of that classical work; the *Flora of Gibraltar*, which, besides a complete list, contains notes on the more interesting species; Linnæus's *Flora Anglica*—the first English Flora—has a bearing upon nomenclature: of all these there are numerous copies.

[*Over.*

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No. 694 OCTOBER, 1920 Vol. LVIII

THE JOURNAL OF BOTANY

BRITISH AND FOREIGN

EDITED BY

JAMES BRITTEN, K.C.S.G., F.L.S.

LATE SENIOR ASSISTANT, DEPARTMENT OF BOTANY, BRITISH MUSEUM.

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The Journal of Botany was established in 1863 by Seemann. In 1872 the editorship was assumed by Dr. Henry Trimen, who, assisted during part of the time by Mr. J. G. Baker and Mr. Spencer Moore, carried it on until the end of 1879, when he left England for Ceylon. Since then it has been in the hands of the present Editor.

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JOHN GILBERT BAKER.

(1834–1920.)

By the Editor.

By the death of John Gilbert Baker at his house at Kew on the 16th of last month, one of the few remaining links which connect the past and present readers of this Journal has been broken. From the first number (published in 1863) until the last volume but one (1918) his name has been of frequent recurrence of these pages; the British botanists with whom he was intimately and constantly associated here and elsewhere—Babington, Newbould, Syme, Trimen, Townsend, to mention only a few of the more prominent—had long pre-deceased him; the number of those who knew him in the days of his activity grows fewer year by year, and to the younger generations he, like those just mentioned, is little more than a name. Yet for those who survive, and for others who may be interested in the history of British botany, some record seems demanded, and this may perhaps best be supplied by one who, for a long course of years, has been familiar with the man and his work.

John Gilbert Baker was born at Guisbro' in the Cleveland district of Yorkshire on Jan. 13, 1834; in the August of that year the family removed to Thirsk, where he was later established in business. He was educated at the Friends' Schools at Ackworth and York; while at the former (in 1846) he began collecting plants, and in the following year became curator of the herbarium at the well-known school at Bootham, whose Nature Study Society—the first of its kind, established in 1836—has implanted in so many of its alumni tastes which have been developed in later years. His first published note was a brief record of *Carex Persoonii* in the *Phytologist* for 1850 (iii. 738), to which periodical he became a frequent contributor.

In 1854, being then of the age of twenty, Baker published his first independent work—*A Supplement to Baines's Flora of Yorkshire*: the introductory matter includes an outline of the relations of the physical geography of the county to its vegetation—a subject treated at considerable length in his important volume on *North Yorkshire* (1863), of which a second edition (completed in 1906) was published in the *Transactions of the Yorkshire Naturalists' Union*. Botanical geography and plant distribution were among Baker's favourite subjects, and furnished the theme for several of his papers; in 1875 he published a very useful little volume entitled *Elementary Lessons in Botanical Geography*, which had previously appeared in serial form in *The Gardeners' Chronicle*. In that journal also appeared his paper on the botany and physical geography of the Holy Land, but this, although not published until 1917, had been written many years before.

In 1859 a Botanical Exchange Club—the origin of the body still bearing that name—was established in connection with the Thirsk Natural History Society; for this Baker wrote the Reports and acted as distributor. In the following year he married Hannah Unthank, of

Newcastle, who until her death in 1902 was actively interested in her husband's botanical work and prepared the diagrams for his lectures. Their son, as the pages of this and other journals show, has inherited his father's devotion to botany.

In 1863 the *Journal of Botany* was established by Berthold Seemann (1825–71) in succession to the long list of Kew Journals, the last of which appeared in 1854; its sub-title "British and Foreign" indicated that it would give due prominence to British botany. The first number contained a paper by Baker "On some of the British Pansies, Agrestal and Montane." In the succeeding volume Seemann dedicated to him the genus *Bakeria*, separated from *Plerandra*, to which it is now generally restored: *Bakeria* of André (Bromeliaceæ) and *Bakerella* Van Tieghem (Loranthaceæ) remain to commemorate him. Baker's contributions to the Journal were very numerous, sometimes extending over many numbers, dealing principally with the petaloid monocotyledons; his monograph of *Selaginella* occupied a considerable portion of the volumes for 1883–85. In 1870, with a view to obtaining more support from British botanists, Baker and Trimen were appointed assistant-editors. The former took no active part in the work, although his name remained on the title-page until 1875; his active cöoperation, however, continued until 1895, when the strained relations then existing between the British Museum and Kew caused a cessation of his contributions, although his interest in the Journal continued. For a list of these, reference must be made to the Royal Society's *Catalogue of Scientific Papers*, wherein Baker's contributions to periodicals occupy many pages.

In May 1864 occurred a catastrophe which, distressing as it was in its immediate effects, was attended by happy results for botany—Baker's house and business premises were completely destroyed by fire, and his herbarium (with that of John Storey) and library, including unpublished MSS., perished in the flames. A subscription was at once set on foot by the leading British botanists, which was generously responded to: "the subscription," said Baker in a letter to those who had contributed, "is far more than sufficient to replace all my botanical belongings which money can restore." In January 1866 Baker was appointed first assistant in the Kew Herbarium—a post which he retained until 1890, when he succeeded Daniel Oliver as Keeper, in which capacity he remained until his retirement in 1899.

The forty-three years spent at the Kew Herbarium formed a period of ceaseless botanical activity: a complete catalogue of Baker's output would fill many more pages than are at our disposal. His first work at Kew was the completion of Sir William Hooker's *Synopsis Filicum*, of which he prepared a second edition in 1874; a supplementary list to date is published in vol. v. of the *Annals of Botany* (1890–91); he monographed the Ferns of Brazil for Martius's *Flora Brasiliensis* and in 1887 published a *Handbook of Fern Allies*. "When I first came to Kew," he says in his preface to the *Handbook of the Irideæ* (1892), "I found the groups of plants that enter largely into horticulture that most wanted working at were the Vascular Cryptogams and Petaloid Monocotyledons"; to the latter he devoted three Handbooks—*Amaryllideæ* (1888), *Bromeliaceæ* (1889), and the *Irideæ* already mentioned: the *Liliaceæ* were treated in vols. xi.–xviii. of the *Journal of the Linnean Society*. He contributed largely to the series of colonial floras prepared at Kew: the sixth volume of the *Flora Capensis*—*Hæmodoraceæ* to *Liliaceæ* (1896–7)—is entirely from Baker's pen; the same orders were also undertaken by him for the *Flora of Tropical Africa*, to which he had already contributed the *Papilionaceæ*, *Labiatæ*, *Verbenaceæ* and other orders, beginning in 1868: he monographed the Brazilian *Compositæ* (2 vols.: 1873–84) for Martius's *Flora*, and the *Leguminosæ* for the *Flora of British India*. Of the extensive collections of the Rev. R. Baron and others in Madagascar, Baker described in the *Journal of the Linnean Society* (1877–1905) more than a thousand new species. The seventeenth volume of *Hooker's Icones Plantarum*, devoted entirely to ferns and comprising a thousand species, is from Baker's pen; he also undertook *The Flora of Mauritius and the Seychelles* (1877)—perhaps the least satisfactory of his works. He also prepared for Mr. Wilson Saunders the text for four of the five volumes of his *Refugium Botanicum* (1868–73).

Meanwhile, as his contributions to this and other journals show, Baker always maintained his interest in British botany. In 1864 he published in *The Naturalist*, then edited by C. P. Hobkirk, a "Review of British Roses," and in the same year published and distributed a set of specimens under the title *Herbarium Rosarum Britannicarum*; this paper he amplified later in the 'Monograph' published in the Linnean Society's *Journal* (xi. 1869). The genus *Rosa*, one of the first which he studied, always retained its attraction for him; a classification of it appeared in this Journal for 1885 and in revised form in Journ. Linn. Soc. xxxvii. 70–79 (1905). His chief undertaking, after his retirement from the Kew Herbarium, was in connection with Miss Willmott's magnificent work on Roses (1910–14), to which he contributed the introduction and technical descriptions.

In 1865 Baker published in this Journal a monograph of British mints, and notes on the plants collected in England and Wales during his holidays appeared from time to time: his interest, indeed, continued to the end, as is shown by the list of Burnham Beeches plants printed in 1917. In 1868 appeared the *New Flora of Northumberland and Durham*, in which he collaborated with G. R. Tate. His *Flora of the English Lake District* (1885) was the result of many visits, and included the "widely-scattered records of [his] forerunners in the botanical exploration of the district": it is prefaced by a bibliography in which particulars are given of some of the authors. Biography always had an attraction for Baker, as many contributions to these pages show—the sketch of his friend H. C. Watson (Journ. Bot. 1881, 265) may be cited as an example: "The Fathers of Yorkshire Botany" (Bot. Trans. Yorksh. Nat. Union, i. 185–201 and "Biographical Notes on the Early Botanists of Northumberland and Durham" (Nat. Hist. Trans. Northumberland &c. xiv. 69–86) contain much information of interest to biographers. To the third edition of Hooker's *Student's Flora* (1870) he contributed the "account of *Rubus*, *Rosa*, and *Hieracium*," and his general assistance is acknowledged in the preface to that work.

Besides these more important works, Baker was a constant contributor to botanical periodicals—among them the Bulletins of the Boissier Herbarium, the Royal Botanical Society of Belgium, and of the Royal Gardens, Kew, the *Naturalist*, the *Gardeners' Chronicle* (including popular monographs of *Crocus*, *Agave*, *Yucca*, *Narcissus*, *Aquilegia*, &c.), and the *Botanical Magazine*, in the preparation of which, apart from his own contributions, he was of the greatest help to Sir Joseph Hooker. His last published paper—"on the Botany and Physical Geography of the Holy Land"—appeared in the *Gardeners' Chronicle* for December, 1917.

This enormous output could only have been achieved by steady and strenuous work, and Baker's industry was unflagging, not only during his official hours at the Herbarium, but at home; when he was living at Richmond, before he took up his residence at the Herbarium, his tall figure, with a bundle of dried plants under his arm, was a familiar object as he passed across the Gardens. He was a very rapid worker; and this, while enabling him to bring together in addition to his own observations a vast amount of material, thus greatly facilitating the work of those who succeeded him, was not without its drawbacks: the criticism of a friendly reviewer of the *Handbook of the Irideæ* (Journ. Bot. 1893, 155) sums these up by saying that "Mr. Baker is a rapid worker and gets over a great deal of ground, but he lacks a certain fineness of touch, so that a want of finish is occasionally evident." In the same way his offhand determinations—"in a large sense," to quote one of his frequent expressions—were sometimes open to challenge, as he himself was always ready to admit.

Although by no means devoid of other interests—he had a keen literary sense and a great love of poetry, of which he could repeat vast quantities—botany was the chief concern of his life, and he was always ready to place his knowledge at the disposal of all who consulted him, whether personally at the Herbarium or by letter. This was especially the case in connection with the Botanical Exchange Club, to whose Reports he was a constant contributor; but it extended to the humblest inquirer. During my two years at Kew, it was amusing to notice the different attitude assumed by Oliver and Baker to the casual visitor—the former discouraging, almost to rudeness, the latter friendly and sympathetic, sometimes to Oliver's hardly disguised disapproval. On my first day in the Herbarium (August 1889), when I had been somewhat over-awed by an interview with Hooker and a little terrified by Oliver's abrupt manner, Baker at once put me at my ease and took me home with him to one of those "high teas" which his intimates will always remember with pleasure, and introduced me to his family, including his son, whose name is now almost as familiar to botanists as his father's, but who then, at the age of five, was sitting on the floor with his sister, absorbed in problems of elementary arithmetic. I recall, too, a pleasant Sunday afternoon when he took me to see Hewett Watson, from whom I had already received much encouragement, at Thames Ditton, when I was delighted at my cordial reception—thanks to my introducer—by one whose writings were characterized by considerable asperity. A reference to these "quiet Sunday afternoons," when Baker was a frequent visitor, will be found in his memoir of Watson (Journ. Bot. 1881, 264).

The kindness which Baker showed to all with whom he came in contact was, I think, his most striking characteristic—no kinder man can ever have lived; the following tribute from *The Garden* for November 9, 1901, aptly expresses the general feeling common to all who knew him:—

"The wide extent of Mr. Baker's public work is written in the history of botanical science, but this slight memoir would be incomplete did it not put on record the pleasant memory of that unfailing kindness and tender beauty of character that so greatly endeared him to his colleagues and subordinates, as well as to his large circle of personal friends. Students and workers in the Royal Gardens felt that in Mr. Baker they had a genial friend as well as an instructor, while many a botanically-ignorant amateur, whether acquainted with him or not, became aware that the learned botanist would with infinite patience and kindness give time and trouble to enlighten him."

The feeling of his colleagues, past and present, found expression on the occasion of Baker's eightieth birthday, when an address of congratulation was presented to him, signed by those who had been associated with him during his long connection with the Herbarium. The *Morning Post* on the following day published an interesting autobiographical account which will be found in this Journal for 1913, p. 42—Baker's correction of the astounding statement which attributed to Mr. Amaury Talbot the collection in Nigeria of 10,000 genera and 200,000 species, will be found on p. 77. Among the many expressions of sympathy addressed to his son which I have been privileged to see, one seems to me so accurate and so admirably expressed that I venture to reproduce it: "He was of the best of men. In his serene disposition he was at peace with God and man. His life was one of cheerful devotion to useful and conscientious work, and in it he leaves behind him a worthy monument. To those who knew him his memory will always be fragrant."

This notice would be incomplete without some reference to the posts which Baker held and to the distinctions which were conferred upon him. In 1869 he was Lecturer on Botany to the London Hospital and for thirty years (1874–1904) to the Kew Gardens: "his lectures" says *The Journal of the Kew Guild* (1897) "have always been popular, his emphatic lucid style being easy to follow, whilst his kindly encouragement, pleasantness, and vein of humour tend to give the tyro a relish for botany which might otherwise be missing": from 1882 to 1896 he was Lecturer on Botany to the Society of Apothecaries at their garden in Chelsea. In 1897 he received the Victoria medal of the Royal Horticultural Society, of whose Scientific Committee he was an original and the oldest surviving member, and in 1899 the gold medal of the Linnean Society. He became a Fellow of the Linnean Society, on whose council he frequently served, in 1866 and of the Royal Society in 1878; in 1902 he was elected a Member of the Royal Irish Academy, and in 1919 the University of Leeds conferred on him the degree of Doctor of Science. He was also an honorary member of various other bodies, including the Manchester Literary and Philosophical Society of Manchester, the Edinburgh Botanical Society, the Tyneside Naturalists' Field Club, the Horticultural Societies of Boston and Massachusetts, the Belgian Société de Botanique, and the Imperial Academy Naturæ Curiosorum.

Although Baker's physical activity was restricted with advancing years, his intellectual interests remained unimpaired to the last, and his death, when it came, was the natural sequence of old age. He was buried on August 19th near his former colleague, Daniel Oliver, in the Friends' Burial-ground at Isleworth, when the staffs of Kew and the Natural History Museum, with Mr. F. N. Williams, the present writer, and personal friends attended to do honour to his memory.

Three portraits of Baker have been published in this Journal: the first (1893, 243) from a painting by Mr. Joseph W. Forster in the Royal Academy Exhibition of that year, representing him at work upon ferns in a pose which all who knew Baker will recognise as characteristic; he is shown similarly occupied in the portrait with attached autograph reproduced (1907, 67) from the *Naturalist* of the same year; the frontispiece to our volume for 1901—a very pleasant presentment—is taken from *The Garden* for Nov. 9, 1900; another portrait, excellent as a likeness but less pleasing in expression, appeared in the same journal, Jan. 1, 1898, as frontispiece to the preceding volume.

DIAGNOSES OF FUNGI FROM "SPOTTED" APPLES.

By Arthur S. Horne.

(From the Department of Plant Physiology and Pathology, Imperial College of Science and Technology.)

During an investigation into the spotting of apples, which commenced at Wisley in 1915, several fungi were isolated* from the diseased tissue underlying the surface spots occurring on apples of many different varieties cultivated in Britain. These fungi do not usually form fertile reproductive bodies *in situ*; they sporulate, however, when grown in potato mush agar. Besides *Leptosphæria vagabunda* Sacc., *Coryneum foliicolum* Fuck., *Fusarium mali* Allerch., *Alternaria grossulariecæ* Jacz., and other readily identified species, the fungi obtained included a number of forms which could not be determined. The latter are now regarded as new species, and technical descriptions are given below for the first time.

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* The writer is greatly indebted to his wife for carrying on this work, thereby saving the cultures, during his absence from Wisley on War Service.

ASCOMYCETES.

Pleospora pomorum nov. sp.

Hyphis varie ramosis, subrepentibus, septatis, fuligineis; peritheciis sparsis v. subaggregatis in maculas brunneas in fructu subimmersis, erumpentibus, pyriformibus, rectis v. curvatis, atris, asperis, circa 1 mm. long., ostiolo circa 94 μ d.; ascis cylindraceis, rectis, brevistipitatis, octosporis, 160–220 μ long, circa 23 μ lat.; sporidiis ovato-oblongis, subclavatis, medio constrictis, inordinate distichis, muriformi-septatis, 7-septatis, longitudinaliter 1–2 rarius 3 seriato-septatis, initio aureis deni fuscis, 31–40 μ long., 10·3–15·5 μ lat. (aureis), 28–34·5 μ long., 13–14 μ lat. (fuscis). Conidiis stemphyliformibus in ramulis acrogenis stipitatis circa 150 μ long., 2·3–3·5 μ lat., ex apice ramulorum inflato colorato, sphæro-quadrilateralibus v. irregularibus, tuberculatis, septis plerumque 3 transv. et 1 longit. divisis, 23–38·5 μ long., 13·5–23 μ lat. fuligineis.

Varieties from which *Pleospora pomorum* has been obtained:—Allingtôn Pippin, Ben's Red, Bismarck, Bramley Seedling, Byford Wonder, Calville Boisbunel, Cardinal, Charles Ross, Cox's Orange Pippin, Domino, Duke of Devonshire, King of Tomkins Co., Loddington, Rival, Royal Jubilee, Tower of Glamis, Wealthy, Winter Quarrenden.

N.B.—Only infertile perithecia have been found in apple "spots."

HYPHOMYCETES.

PHOMATALES (SPHÆROPSIDACEÆ).

The non-stromatoid hyalosporous amerosporous Phomatales hitherto described by systematists comprise genera with simple pycnidia. The pycnidium of such a fungus—for example, that of a *Phoma* or *Phyllosticta*—consists of a sphæroidal body from which the spores issue by way of a circular orifice, or in some species the body is terminated antically by a conoidal elevation, which, for example, in *Phoma lingam* (*P. oleraceæ* Sacc.) is 80 μ–140 μ long, and measures 200 μ–350 μ in diameter at the base. The pycnidia of the species isolated from apple, however, although unilocular as in *Phoma*, differ from the strictly phomoid type in developing one or more tubular neck-like outgrowths, which are often bent or curved and even branched.

Accordingly a genus has been established possessing these unusual characteristics, and the name *Polyopeus* * has been given to it. The genus comprises a series of forms ranging from species with pycnidia occurring singly, and more rarely aggregated (*P. purpureus* and *P. pomi*), to others in which the pycnidia develop as a rule in closely associated groups presenting a stromatoid appearance as well as singly (*P. aureus* and *P. recurvatus*).

Polyopeus nov. gen.

Pycnidia immersa v. subimmersa, solitaria, aggregata v. congesta, unilocularia, hyalina v. sub-carbonacea, subglobosa v. irregularia, unirostrata vel multirostrata, membranacea; rostra tubuliformia; sporulæ continuæ plerumque ellipsoideæ, hyalinæ vel rarius coloratæ.

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* I owe the suggestion of the name to Professor J. B. Farmer.

Polyopeus purpureus nov. sp.

Hyphis roseis, purpureis v. hyalinis; pycnidiis subglobosis, atris, atrofuligineis v. hyalinis sed nigrirostratis, irrumpentibus, 140–360 μ long., 100–220 μ lat.; 1–6 rostratis; rostris 48–120 μ long., ad basum et ad apicem 28–60 μ lat., versus medium rarius 112 μ lat.; sporis hyalinis, ellipsoideis, 5–8·5 μ long., 2–3·5 μ lat., in cirros varios roseos v. hyalinos exsilientibus.

Var. *verus*: hyphis roseis.

Var. *incoloratus*: hyphis non roseis: pycnidiis atris.

Var. *latirostratus*: hyphis non roseis; pycnidiis atris; rostris latis.

Var. *nigrirostratus*: hyphis non roseis; pycnidiis hyalinis sed nigrirostratis; rostris latis.

Varieties from which *Polyopeus purpureus* has been obtained:—Bismarck, Byford Wonder, Cardinal, Charles Ross, Christie Manson, Cox's Orange Pippin, Early River Grenadier, Hanwell Souring, Hoary Morning, Lane's Prince Albert, Loddington, Newton Wonder, Pott's Seedling, Royal Jubilee, September Beauty, Stirling Castle, Winter Hawthornden, Winter Quarrenden, Wolf River. Fertile pycnidia were found in Early River and Stirling Castle.

N.B.—The nigrirostrate character is evident when growth takes place in Crabill's medium (C. H. Crabill in Amer. Jour. Bot. ii. 1915).

Polyopeus pomi nov. sp.

Hyphis albis v. fuscescentibus; pycnidiis subglobosis v. irregularibus, fuligineis v. hyalinis sed nigrirostratis, versus ad 2 mm. long., 1-multirostratis; rostris rectis v. curvatis, simplicibus v. furcatis, versus 240 μ long., ad basum 50 μ lat., ad apicem 40–60 μ lat., versus medium 80 μ lat.; sporis hyalinis, ellipsoideis, 5–9 μ long., 2–3 μ lat., in cirros hyalinos exsilientibus.

Var. *verus*: pycnidiis atris intus hyalinis.

Var. *torpidus*: pycnidiis hyalinis sed nigrirostratis intus roseis.

Isolated from Cox's Orange Pippin in 1915.

Polyopeus recurvatus nov. sp.

Hyphis albis v. olivascentibus; pycnidiis aggregatis v. congestis, sæpe solitariis, globosis v. subglobosis, hyalinis v. atris, 132–240 μ long., 92–140 μ lat. (unirostratis), 220–260 μ long., 120–140 μ lat. (multirostratis); rostris paucis, rectis, curvatis vel reflexis, 40–120 μ long., ad basum 40–80 μ lat., ad apicem 32–72 μ lat.; sporis hyalinis, ellipsoideis, 4–5 μ long., 1–2 μ lat., in cirros hyalinos exsilientibus.

Var. *verus*: rostris recurvatis.

Var. *curvatus*: rostris curvatis.

Isolated in 1918 from the variety Hoary Morning. Subsequently obtained from Lane's Prince Albert.

Polyopeus aureus nov. sp.

Hyphis ochrescentibus; pycnidiis aggregatis v. congestis rarius solitariis, globosis v. subglobosis, atris, 1–5 rostratis v. ostiolatis, 103–200 μ long., circa 75 μ lat. (unirostratis v. uniostiolatis), 940 μ long., 470 μ lat. (multirostratis v. multiostiolatis); rostris v. ostiolo

circa 37 μ d.; sporis aureis, fuscescentibus, oblongatis v. ovoideis, 5–6·8 μ long., 2·4–3 μ lat. in cirros aureos v. fuligineis exsilientibus.

Isolated in October 1915 from Cox's Orange Pippin. Reisolated from the same variety in January 1918, and later from Margil (Jan. 31st), American Mother (Jan. 31st), and Alfriston (Feb. 25th).

Synopsis of the Species and Varieties of Polyopeus.

This synopsis has been devised from observations on growth and pycnidial development in Crabill's medium, with wheat starch substituted for maize starch. A spore inoculant was used and the cultures were incubated at 20° C.:—

Pycnidia usually occurring singly.
Pycnidia paucirostrate (usually 1–6).
Vermilion colour absent, mycelium rose to purple or not coloured .... *P. purpureus.*
Pycnidia angustirostrate.
Aerial mycelium coloured; pycnidia usually nigrirostrate, numerical increase rapid; spore masses pink. Var. *verus.*
Aerial mycelium scanty and not coloured; pycnidia dark, numerical increase rapid; spore masses almost hyaline .... Var. *incoloratus.*
Pycnidia latirostrate.
Aerial mycelium scanty and not coloured; pycnidia dark, numerical increase rapid; spore masses almost hyaline .... Var. *latirostratus.*
Aerial mycelium white; pycnidia usually nigrirostrate, numerical increase rapid; spore masses pale pink .... Var. *nigrirostratus.*
Pycnidia multirostrate.
Vermilion colour develops late, mycelium not coloured purple .... *P. pomi.*
Aerial mecelium scanty; pycnidia dark, numerical increase rapid; spore masses almost hyaline .... Var. *verus.*
Aerial mycelium present; pycnidia usually nigrirostrate, numerical increase *slow*; spore masses rose .... Var. *torpidus.*
Pycnidia usually in stromatoid aggregations.
Spores relatively small, "necks" bent or recurved .... *P. recurvatus.*
"Necks" recurved.............................. Var. *verus.*
"Necks" bent .... Var. *curvatus.*
Spores coloured .... *P. aureus.*

Fuckelia botryoidea nov. sp.

Stromatibus rarius solitariis v. botryose cæspitoso-aggregatis v. pulvinato-congestis, glabris, hyalinis, roseis v. nigrescentibus, solidis, intus in locellos paucos v. numerosissimos partitis, multirostratis v. multiostiolatis; sporis hyalinis, ellipsoideis, biguttulatis 6–7·2 μ long., 2–2·8 μ lat.

Isolated in October 1915 from Cox's Orange Pippin and later from the Margil (Nov. 15, 1917) and Frogmore Prolific (Dec. 20, 1917) varieties.

The phæosporous Sphæropsidaceæ include two species. One of these, an undoubted *Coniothyrium*, which exhibits cultural dimorphism *, is identified as a variety of *Coniothyriun cydoniæ*. The other, which differs from a typical *Coniothyrium* in possessing lobed pycnidia, is named *Coniothyrium convolutum*.

Coniothyrium cydoniæ Brun. var. **mali**, nov. var.

Hyphis in zonas brunneas dispositis v. albis; pycnidiis sparsis, circa 200 μ d.; sporis globosis v. oblongo-globosis, olivaceis, 5–6 μ long., 4–5 μ lat.

Isolated from Cox's Orange Pippin Jan. 31st, 1918.

Coniothyrium convolutum nov. sp.

Hyphis fuligescentibus; pycnidiis solitariis, atris, subglobosis, ad basim frequenter lobatis v. irregularibus, subimmersis, ostiolatis, 131·6–169·2 μ long., 75·2–112·8 μ lat.; sporis ovoideis, aureis, fuligescentibus, 4 μ long., 1·3–2 μ lat., in cirros aureos v. brunneos exsilientibus.

Isolated from the variety Afriston on October 30th, 1917.

MELANCONIALES.

Alternaria pomicola nov. sp.

Hyphis albis, nigrescentibus, septatis; conidiis in conidiophoris erectis ramulosis circa 96 μ long., 2·4–3·2 μ lat. (ramis racemose dispositis), et interdum in conceptaculis immersis olivaceo-fuligineis circa ½ mm. long. dispositis, fuscis olivaceisve, sublageniformibus, 40–60 μ long., 10–14 μ lat., ad septa vix constrictis, 8–9 transvers., 1 longit. præditis.

Isolated from Cox's Orange Pippin (Hailsham, 1915).

MYCELIA STERILIA.

Sclerotium stellatum nov. sp.

Hyphis albis; tuberculis superficialibus v. immersis, solitariis v. aggregatis, atris intus hyalinis, subsphæroideis ovoideis v. irregularibus, rectis vel curvatis, 16–72 μ d., 90–180 μ long., 40–80 μ lat.

Isolated from Cox's Orange Pippin (Hailsham, October 25th, 1915). Named from the appearance resembling a many-rayed dark star which it presents when grown in potato agar plate cultures.

The author is indebted to the botanical authorities of the British Museum of Natural History for help in preparing the technical descriptions.

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* See C. H. Crabill in Amer. Jour. Bot. ii. (1915) p. 449.

THE BRITISH MARSH ORCHIDS IN RELATION TO MENDELIAN PRINCIPLES *.

By Rev. T. Stephenson, D.D., and T. A. Stephenson, M.Sc.

The brief discussion here presented is by way of introduction to a forthcoming paper on the groups of *Orchis latifolia* L. The present tendency is to deny that the species occurs in Britain at all, whilst at the same time conceding that probably it does occur on the Continent. Our own impression is that a very similar set of forms exists in both cases, only much more complex in the greater area. Pending critical experiments, it will do no harm to explore some of the possible conditions of the problem. As a good deal of work is being done at the present time in this group, we may at once refer to some of the most recent papers. In the Reports of the Winchester College Natural History Society for 1915–1917, and in preceding issues, there are some excellent records and discussions, together with several photographs of interesting types: the forms dealt with all grow near Winchester, and many exceedingly interesting hybrids are described. Independently of Dr. Druce, a type of unspotted Marsh Orchis was separated as a second form of *O. incarnata*, which now has the rank of a species as *O. prætermissa* (Druce). The Botanical Exchange Club Reports for some years past have devoted much attention to the group: the 1917 Report contains a review of the Marsh Orchids, by Dr. Druce, who also summarizes the Winchester Reports. In these Reports are full discussions of the species founded by Dr. Druce—namely *O. prætermissa*, *O. Fuchsii*†, and *O. O'Kellyi*, as well as some new varieties. In the *Orchid Review* for July 1918 (xxvi. 162) Mr. Rolfe has written upon the whole group, and in Sept.–Dec. 1919 a list of natural hybrids is given. In this Journal for 1919 (137–142), Col. Godfery writes on "The Problem of the British Marsh Orchids"; his knowledge of Continental species makes his observations of much value. Research in this group owes very much to Dr. Druce, who has probably examined Marsh Orchids *in situ* in almost every county of the British Isles: the present writers cannot claim such wide experience, and are glad to acknowledge a great debt to his published work and to assistance privately given.

Col. Godfery presents two general hypotheses of the relations of the Marsh Orchids: (1) that there are only two main species, namely *O. incarnata* and *O. prætermissa*, the rest being hybrids of these species with forms of *O. maculata*; (2) that there are three main species, namely the two just mentioned and ring-spotted *O. latifolia*. In this case, reckoning *O. Fuchsii* as distinct from *O. ericetorum*, nine hybrid varieties are possible, not reckoning *O. Fuchsii* × *O. ericetorum* (= *O. transiens* Druce). We decidedly prefer the second alternative, only we by no means think that *O. latifolia necessarily* has ringed spots. It certainly often has them, especially in luxuriant specimens, but is just as often without them; we have found plants of more than one type which differed in no particular of importance except that some had solid spots and others rings. We should agree, as against Dr. Druce, that the presence of rings is no sure test of the presence of a cross; in many cases the rings plainly indicate a fulness and even excess of pigment, not its dilution—for instance, ringed spots are sometimes found in pure *O. ericetorum.* We have seen plants of this species on Tregaron Bog with very strongly marked rings on the leaves; on the other hand, it is quite common to see very faint rings or blotches or spots, and here probably a cross is involved.

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* Owing to an unavoidable delay in the printing of the Plate illustrating the species of *Orchis*, the present paper appears out of its due order.

† N.B.—We are using the names *O. Fuchsii* Druce and *O. ericetorum* Linton for the sake of clearness, to distinguish the two British groups of Spotted Orchids: by *O. maculata* L. we indicate the aggregate species.

In cases of undoubted natural hybrids there is much variation in the matter of spots, though we have not as much evidence on the point as we should like. Hybrids of *O. ericetorum* with *Gymnadenia conopsea* have been seen by us (*a*) with unspotted leaves, (*b*) with slight and few spots, (*c*) with numerous small spots, and (*d*) with blotches but not rings. Hybrids between *O. maculata* and species with unspotted leaves may therefore have unspotted leaves; but in this case one would have to be sure that the parent *maculata* itself was without spots. Until a point like this has been much more fully investigated, we cannot say whether spots are necessarily a dominant character; full notes about the occurrence of spots in plants of *O. Hepburnii* and *O. Scampstonensis* would be of considerable interest in this connection. Mr. St. Quintin reports in a letter that the hybrids of *O. foliosa* with *O. Fuchsii* at Scampston Hall have in some cases spots, in others blotches; sometimes well-marked rings and sometimes very faint rings.

Col. Godfery asks several questions, the answers to which would, when collated from many districts, be of great significance. It would help much to know of localities in which *O. latifolia* grows, as it certainly does on the Continent, apart from other forms, or apart from one of the groups from which hybridization is claimed always to occur. The fact is that *O. maculata*, in some form, is so ubiquitous that it is difficult to find any place where orchids grow from which it is absent.

The general principle on which we are working in regard to the leaf-character is that *O. incarnata* and *O. prætermissa* (and *O. O'Kellyi*) *never* have spotted leaves, and that *O. purpurella*, *O. latifolia*, *O. Fuchsii*, and *O. ericetorum* normally have spotted leaves, though in each case some individuals are without them. Mr. A. D. Webster, who has studied carefully the variation of *O. maculata*, says (*British Orchids*, pp. 64, 65): "In several districts I have noted that the proportion of these (unspotted plants) to that of the typical plant is as three to seven." He can find no cause for the variation either in soil, altitude or situation.

In regard to the genetic relations of the forms, we are in the region of almost pure speculation. We have a few cases of undoubted natural hybrids, but otherwise no experimental work to record. In order to get light on the vexed question of *O. latifolia*, we need experimental crosses of various kinds, and the raising of the progeny of these crosses, if fertile, through at least three generations. The difficulty here is both the uncertainty of germination at the outset and the slow growth to the flowering stage. This has been set down as seven years; but that period would probably be much shorter under favourable conditions. In any case it would seem that the experimental work could best be carried on at some plant-breeding institution, where continuous work through many years might be assured. It would not be enough, by a cross, to get some plant very near to *O. latifolia*. It would be necessary to find out whether this form were fertile; if it were, there is no reason why it might not establish itself in numbers and perpetuate itself as a separate species.

In the absence of guiding experiments, we are bound to discuss the origin and connections of these types with some ideas in our minds as to the manner in which one form has arisen out of another. Presumably we all believe either in evolution (in the strict sense) or in epigenesis, and for the purposes of this study they mean the same thing. We are bound to have some theory of the origin of types so fully segregated as say *O. ustulata* and *O. morio*, and such types as the Marsh and Spotted Orchids, in a state of "polymorphic mixture." For this we are obliged to fall back upon Mendelian study and to seek what assistance we can get from the laws of mutation and segregation so far as they have been elucidated. Perhaps not much help is here to be expected; but we may at least be able to determine what is possible, if not what is probable or necessary.

In these matters the opinions of botanists seem to be very much in chaos. One will deny that mutation is a *vera causa* of new species, and another that crossing may so result; and between the two we are left with no theory at all. One will say that mutations only affect single characters and species are built up on numerous characters; or that if you get hybridization at all freely, the result is a jumble of polymorphic forms, out of which no species can be distinguished, and in the midst of which nothing is stable. This would seem to lead us straight back to the old position that if two forms crossed they must be reckoned to belong to the same species. Here we might do well to quote a sentence or two from Bateson's Presidential Address to the British Association at Melbourne in 1914:—"Who could have foreseen that the Apple and the Pear—so like each other that their botanical differences are evasive—could not be crossed together, though species of *Antirrhinum* so totally unlike as *majus* and *molle* can be hybridized without a sign of impaired fertility?"—and then, "The only definable unit in classification is the homozygous form which breeds true" (p. 13). We know as yet very little, if anything, about the conditions of compatibility where crossing occurs: in the meantime it seems to us most important to keep in mind the possibility that in cases of polymorphic mixture we may have true-breeding races which also freely cross with other species. The problem is to distinguish the pure from the heterozygous forms, where all are growing in close association.

In our view, both mutation and crossing are true causes of new species. On the latter point one or two quotations may serve to indicate the trend of expert opinion. Mr. Rolfe (*Orchid Review*, xxiii. p. 229), in an article on "The Mechanism of Heredity," says: "A complete blending of character"—*i. e.* in the case of a perfectly successful crossing—" would result in a batch of uniform secondary hybrids, and Mendel himself appreciated the fact when he pointed out that hybrids in which the diverse elements were permanently accommodated together reproduced themselves true from seed, and had all the attributes of species." Here it may be noted that, if a cross affecting several characters is fully fertile, not only are there types in which perfect and stable blending may occur (in the second hybrid generation), but types in which it must and will occur. From that point, granted continued fertility and equally favourable environment, those types can never be swamped and lost.

Mr. Bateson evidently regards mutation as the chief cause of new species, crossing coming in as a further contributory cause. In his Presidential Address already quoted he sums up the case for variation as fundamentally due to an "accidental" change, *i. e.* mutation, of germinal tissue, and then says, " Distinct types once arisen, no doubt a profusion of the forms called species have been derived from them by simple crossing and subsequent recombination. New species may be now in course of creation by this means, but the limits of the process are obviously narrow."

This seems to us the true relation of the two processes. The *first* deviation from the norm arises, from causes as yet hardly even guessed, in some individual, as in the case of the Shirley poppy or the Victoria plum. If now self-fertilization is possible, the strain may survive or be artificially preserved; but if it is cross-fertilized, it is only in the second hybrid generation that it may reappear in its pure form, and continue as a species. Such a history may underlie our acquisition of a "thrashable wheat," of which Mr. Bateson says, "the original may have occurred once only in a single germ-cell."

As to whether a similar or even identical mutation might arise in several individuals simultaneously, in the same or in different places, we are not aware of any definite evidence to guide us. It is the sort of thing one might expect. seeing that no form can vary just anyhow. It has already, by being what it is, been cut off from a vast number of modes of change. The group of organisms to which it belongs has acquired a certain constitution, which may determine that variations must be in some definite general directions. The same consideration will make it reasonable to suggest, without at all denying the initial "general" variability of all organisms, that mutations in any given species are likely to follow in a serial order which may appear pre-determined, but is mainly self-determined. From an original parent stock several such series might arise, following a roughly parallel course.

Upon the contention that mutations affect only single characters, and that therefore a "mutation" can never become a "species," it should be observed that since the change is first of all in the germinal constitution, it is inevitable that it should affect more than one external character. This fact has been disguised, as Prof. Punnett has privately suggested, by the fact that, in the beginning of the genetic studies, some one conspicuous character was isolated for the purposes of report and discussion. A more exact study would show many allied external changes. But even if only a very few external characters are different, and the form breeds true, we get what, if classification has any real value, is a distinct species.

Where forms freely cross, as in the case of the Marsh and Spotted Orchids, it may be argued that alongside the pure parents there will arise a confused multitude of hybrids, with so many cross-variations that no attempt to classify them is possible, and no true species will emerge. We do not believe that the facts, as we interpret them, support this view. In any large assembly of these plants we may note, first, the occurrence of individuals, either solitary or in very sparse numbers, which are certainly hybrids, but show no sign of originating new strains, and, secondly, of hybrids in fairly large numbers and usually of fairly uniform type, which may or may not be fertile, and, in fact, established species. It may be said with some confidence of most of these groups that they have been known and observed in many localities ever since botany as a science has been in existence, and probably they have changed but little either in type or in comparative numbers. It also seems generally observed that where there are hybrids present in good numbers, nevertheless one or both parents are present in far greater numbers. That is, the population is fairly stable, and the freest crossing never seems to result in the swamping of the parent forms. That hybridization does not necessarily involve a chaotic confusion of characters is made quite plain in a paper by Hardy in *Science*, July, 1908, to which Prof. Punnett has kindly called our attention. where it is shown that, in a mixed population, "there is not the slightest foundation for the idea that a dominant character should show a tendency to spread over a whole population, or that a recessive should tend to die out." A stable condition of balance is soon reached, and once reached is not seriously disturbed, apart from special external conditions. See also *Mimicry in Butterflies*, by R. C. Punnett, 1915, pp. 154–156. Our reading of the evidence would be that we have a large number of assemblages of Marsh Orchids in which some may be non-fertile hybrids, resembling each other because their parents resemble each other. Others may be groups of plants which are pure strains derived from second generation hybrids. Others, again, may be groups which have originated in a mutation. In this last case, unless on the rare condition of more than one identical mutation at the same time and place, and a crossing of these, the new strain would emerge from the second hybrid generation of a cross between the mutation and the original or normal form. Thus we may have several pure strains growing together in various habitats and freely hybridizing. This will result in a great confusion of individuals, capable nevertheless of being reduced to some sort of order by careful study and comparison of assemblages of plants growing in many different localities.

BIBLIOGRAPHICAL NOTES.

LXXXI. TRADESCANT'S FIRST GARDEN CATALOGUE, 1634.

IN his article on *A Seventeenth-century Botanist Friendship* (Journ. Bot. 1918, p. 197) Mr. Boulger has published some interesting details relating partly to the trees found growing in the Lambeth Garden when it came into the possession of Elias Ashmole in 1662 on the death of John Tradescant the younger; partly to plants received in the years 1629 to 1633 "from forrin partes." These latter lists and notes are attributed to John Tradescant the elder.

Mr. Boulger follows the usual practice of naturalists who refer to the Tradescants, in quoting the *Musaeum Tradescantianum* printed in London by John Grismond and sold by Nathaniel Brooke at the Angel in Cornhill in 1656, nineteen years after the death of the elder Tradescant. I have therefore come to the conclusion that the copy of the elder Tradescant's own catalogue which I have usually consulted is a very rare if not unique psssession. It was bequeathed by John Goodyer to Magdalen College and is duly mentioned in the printed Catalogue of the Library (1862). I know of no other copy.

The title is :

"PLANTARVM
IN HORTO
IOHANNEM TRADE-
SCANTI *nascentium*
Catalogus

NOMINA SOLVMMODO
Solis vulgata exhi-
bens. Anno 1634"

At the head of the first page (sig. A 2), the title is repeated with the author's Christian name in a more correct case :—IOHANNIS. Then follows a list of some 750 species and varieties of plants distinguished by their Latin names in alphabetical order. A Catalogue of Fruits fills the last five pages. Altogether the lists are much shorter than those in the 1656 edition of the Catalogue, and a comparison of the two would show what plants might have been introduced in the intervening period.

The 1634 lists include the *Narcissus Roseus maximus flo. pleno Tradescanti* and the *Phalangium Virginianum Tradescanti* and apparently all the other plants mentioned by Mr. Boulger. The spelling is usually good, showing that if Mr. Boulger's quotations are a fair indication of Tradescant's illiteracy, some better scholar must have had a hand in the construction of the Catalogue and in the reading of the proofs. I hope to reprint the complete list shortly.

R. T. GUNTHER.

MYCOLOGICAL NOTES. V.

By W. B. Grove, M.A.

(Continued from Journ. Bot. 1919, 210.)

Russula claroflava Grove.

This species was first described in the *Midland Naturalist*, 1888, p. 265, from specimens found near the bog at the top of Windley Pool, Sutton Park, in that year. A figure was sent to Cooke and appeared in his *Illustrations of British Fungi* as plate 1196; Cooke added a sketch from a fungus found at Queen's Cottage, Kew, which does not seem to represent the same species. I have since found exactly the true form, keeping its characters unchanged, in three other places: (1) the boggy ground by Bracebridge Pool, Sutton Park; (2) the similar ground at Coleshill Bog, both in Warwickshire; and (3) a bog at Burnham Beeches, last year, *i. e.* four times in thirty-one years. The fact now becomes evident that this fungus grew, in each instance, in a place of precisely similar character—namely, on grassy ground among scattered trees on the edge of a *Sphagnum* bog. It is evidently very uncommon, and does not seem to be a variety of any other described species. It has a pileus approaching that of *R. fingibilis* Britz., pl. 1048, but of a distinct chrome-yellow, while the stem is like that of *R. ochroleuca* Pers., pl. 1049, but the edge of the pileus never turns up as in that species. Massee, in his *Fungus Flora*, iii. 65, mistakenly added to the description the word "Acrid?" A revised description is appended:—

Russula claroflava mihi. Pileus 5–10 cm. across, firm, convex, then depressed, margin even or faintly striate, turned down even when old, deep chrome-yellow, paler on the margin, stained here and there (where abraded) with a rufous tinge; flesh yellow beneath the cuticle. Stipe 5–6 × 2½ cm., white, spongy within, somewhat granular, occasionally stained with pale chrome-yellow patches when young, rugose exactly as in *R. ochroleuca* and ultimately becoming covered with dark-cinereous streaks as in that species. Gills rather thick, straight, not forked, but often joined in pairs near the stem, obtuse and broad in front, narrowed behind, adnexed, altogether tinged with pale yellow, then becoming pale subochraceous; cystidia elliptic-lanceolate, not much projecting. Spores globose, echinulate, 8–9 μ diam.

On grassy ground among trees on the margin of *Sphagnum* bogs. Flesh of pileus firm, but cheesy; smell faint, but not unpleasant; taste becoming unpleasant, but not acrid, with age; colour of pileus rich, pure, and bright.

Boletus sanguineus With.

In his *Botanical Arrangement of British Plants*, ed. 2, iii. 414, Withering described what he called the *crimson Boletus* (*B. sanguineus*) from Edgbaston Park. No one else seems to have met with a fungus exactly agreeing with his description, but this summer I had the pleasure of finding in my own garden, which is less than a mile distant from Edgbaston Park, what is evidently the same plant. The description is as follows:—

Boletus sanguineus With. Pileus 6–7½ cm. across, convex or flattish, when old concave, *i. e.* turned up all round the magin, blood-red, dull, opaque, then dark reddish-brown, nearly uniform all over, but slightly paler or with subpallid spots in the centre, not cracked, not distinctly tomentose, but grumose with little shallow irregular pits when old, slightly viscid; flesh whitish, turning slowly blue when cut, beginning near the pores. Pores yellow, $\frac{1}{2}$–$\frac{3}{4}$ cm. long, shorter near the stem, but slightly decurrent, large and somewhat compound when old, turning dark blue or greenish where touched. Stipe $3\frac{1}{2}$–$5 \times 1\frac{1}{4}$–$1\frac{1}{2}$ cm., glabrous (not fibrillosely striate), even, yellow like the gills, clouded here and there with dilute crimson, somewhat thicker below; flesh yellow, tinged with red within. Spores fusoid, pale olivaceous, 12–13×4–$4\frac{1}{2}\ \mu$.

Among grass in my garden, July, 1920. A coloured sketch will be deposited in the collection of figures at Kew.

This is a satisfactory identification of a rare and dubious Midland fungus; there is more pleasure in such a recognition of what was intended by one of the old pioneers than in finding a new species. Withering seems to have found it first in the button state, but he also describes the more advanced state which was absolutely identical with my specimens, so far as words go. But, so long ago as 1886, I found amongst grass in Packington Park (ten miles away) a fungus which seemed to combine the characters of *B. sanguineus* with those of *B. subtomentosus*. The pileus differed from that just described in being slightly cracked, feeling like kid-leather when dry, the stem was ribbed and tapered downwards, and the flesh of the pileus reddish below the cuticle. Also there have occurred at Barnt Green and Berkswell specimens referred to *B. versicolor* Rost. (the name was confirmed at Kew) which had the pileus of a beautiful pinkish-purple (no trace of olive), uniform all over and faintly granulated, not cracked, pores and stem much as in *B. chrysenteron*.

The similarity of all these specimens proves that they should be classed under one head, say, *B. chrysenteron*. The only reasonable solution of the difficulty lies in a system of super-species and sub-species, the latter being *euchrysenteron*, *sanguineus*, *subtomentosus*, and *versicolor*. The continental influence, which has set us against the adoption of this commonsense device for representing the facts, is now happily declining in our midst.

MONILIA CANDICANS Sacc. Syll. iv. 32; Fung. Ital. pl. 57.

Fertile hyphæ forming short aggregated tufts, yellowish, then whitish, erect or diverging, at length irregularly branched above, colourless under the microscope, distantly septate, about $7\ \mu$ wide. Conidia in short chains (up to five or six in each chain), springing from small denticles on the hyphæ near the summit of the upper cells, lemon-shaped, hyaline or faintly coloured, 15–18×9–$10\ \mu$.

On soft carious wood, Cofton Park, near Barnt Green, July, 1920.

This fungus exactly agrees with Saccardo's description and figure, but it is more interesting because it seems likely that it is the same as the minute fungus which Purton records in his famous *Midland Flora* (1821, vol. iii. p. 320) under the name *Monilia cæspitosa* Relh. He also figures it in his plate 34, which he tells us is "a very accurate drawing taken from the fresh plant by my niece Miss Cooper, of Hampstead." There has been considerable doubt about the identity of this fungus, which is described and figured as having ternate spikes of spores. Saccardo (following Purton) considers it, in Syll. iv. 35, to be the species called *M. racemosa* by Persoon (Syn. p. 692) and *Mucor cæspitosus* by Bolton (pl. 132, f. 2), and he attributes to it "*ex icone*" globose spores.

Purton considers it also to be the "Aspergillus terrestris, cespitosus, ac ramosus, albus" of Micheli (pl. 91, f. 4), and at the same time his "Aspergillus albus, tenuissimus, graminis dactyloidis facie, seminibus rotundis" (pl. 91, f. 3). Bolton's figure is undoubtedly the same fungus as Micheli's fig. 4. Purton's figure, which is almost identical with that of Micheli (fig. 4), is very similar to that of Bolton and evidently contains suggestions of both.

All these latter show constant ternate spikes of spores. The Cofton Park Fungus had many ternate, but also many with one or several spikes, also some with unbranched stems as in Micheli's fig. 3. With the low powers which these authors had to use the spores do look round, although with modern microscopes they are seen to be lemon-shaped. I would suggest that, as the fungus which they met with was no doubt common (it is referred to by many authors of those times, as by O. F. Muller in Flor. Fridr. p. 228), they have misled us by representing the *ternate* spikes as universally present, instead of being only occasional. The reason why they are often ternate is that there is usually a denticle on the summit of a branch with often two denticles at a slightly lower level. The figures of Bolton and Purton show that the draughtsmen were under the influence of Micheli's fig. 4.

NOTE.—In "Mycological Notes.—IV." in this Journal for 1919 there were two omissions. On p. 207, last line, a *Phyllosticta* is mentioned without a name; this should be *P. bellunensis* Mart. In the description of the many-septate spores of *Sphærulina intermixta*, f. *valde-evolula* (p. 210), it was not mentioned that these were in no sense beginning active germination. The branches were still attached to the bush, and they and the perithecia were quite dry. Brefeld has figured exactly similar spores in the same species as occurring in his cultures when active germination was beginning.

(To be continued.)

SHORT NOTES.

HERBARIUM PESTS. The method of poisoning herbarium specimens by means of perchloride of mercury in spirit is often objected to, and comparatively few amateur botanists resort to it. For cleaning sheets that have become affected with pests, as well as for treating specimens before they are put away, I am in the habit of using a saturated solution of naphthalin in petrol. This is applied rapidly by means of a large camel-hair "mop" brush, the petrol quickly evaporating and leaving the naphthalin as a crystalline deposit in the interstices of the plants. A large number of sheets can be dealt with in a short time by this method. The petrol leaves no stain, and has no injurious effect. Of course, the process must be carried out in daylight and the highly inflammable nature of petrol vapour borne in mind. When the petrol has evaporated, which takes only a few minutes, the sheets can be quite safely replaced in the herbarium. The solution is also used for worm-eaten wood, being injected into the worm-holes by means of a syringe with a fine nozzle. Where the smell of naphthalin is objected to probably camphor could be used in the same manner.—H. Downes.

Moehringia trinervia Clairv. In Pryor's *Flora of Hertfordshire* (p. 499) Dr. Jackson identifies "Alsine montana minima Acini effigie rotundifolia" of Ray's *Synopsis* (ed. 1, 240) with this plant on the faith of "a specimen labelled by Plukenet in the Sloane Herbarium, vol. 91, fol. 17." The identification, which had been indicated by Newbould in the Departmental copy of the *Almagestum* (p. 20) is doubtless correct; but the label attached to the specimen does not bear the Rayan name—the inscription runs: "Alsine minor foliis rotundis C. B. pin. Alsines minoris alia species Thalii ocimi facie Nobis." In the *Almagestum* Plukenet adopts the Rayan name, quoting Bauhin's as a doubtful synonym. Whether the specimen in Herb. Sloane actually came from the Hertfordshire locality is I think doubtful: it is not localized, and the "Herbarium Vivum" in which it appears is a general collection.—James Britten.

Helleborine latifolia Druce. A very splendid specimen of this plant has been brought to me, which shows that under favourable conditions it can grow to dimensions much in excess of those stated in text-books. This Helleborine towered straight from the ground to an height of 3 ft. 11 in., and bore perfect leaves, and no less than 58 flowers, all of which were expanded at the same time on a spike 17 inches long. It grew at the edge of a small opening in a Somerset wood close to Bristol, where the plant of ordinary size has become much more plentiful in recent years.—Ida M. Roper.

Hutchinsia petræa and its Seeds. On April 10th, 1920, I gathered on a limestone scree near Bristol a large plant of *Hutchinsia petræa* measuring 7 × 6½ inches. It has 55 heads, with from 35 to 50 seed-capsules per head—average, say, 40. This gives about 2200 pods, and if each pod produced its full complement of four seeds no less than 8800 seeds would be formed; but after examination of many specimens gathered in 1888 and in recent years, three would seem the average number of seeds that come to maturity. Often there are only two seeds in a pod, and sometimes one. During the past few years *H. petræa* has been very prolific in the restricted places where it grows near Clifton; and it is also increasing on the Somerset side of the Avon. Known there very sparingly many years ago, it appeared again somewhat recently, and has now become well established close to the river. This year on the Gloucestershire side seedlings half an inch high opened their minute flowers as early as Feb. 12th. Occasionally in mild weather the winter vegetative state of strong seedlings is remarkable; but I believe it can hardly be considered biennial. A dried specimen of average size (two to three inches) weighs only about 8 grains, or about the weight of 12 unused postage-stamps. The small seeds retain their uniform yellow colour for at least three-quarters of a century, and when once dry they do not perceptibly shrink in size. I was told that one or two botanists barely succeeded in finding *Hutchinsia* at Clifton three or four seasons ago, when directed to one of its stations at a time when many thousands of the minute plants were visible; but these require careful searching for in the right habitat. The little wiry plants have a distinct protective colouring, and are usually most abundant and finest on the edges of certain limestone screes, partly protected by low thicket. It needs far less moisture or humus than the milk-white, more leafy *H. alpina*, a lover of loose shingle in the Alps; and the bare or even moss-covered rock is not the best place to look for *petræa*. Hudson recorded the plant from Uphill, Somerset, and Collins from Cheddar. Repeated search by modern botanists in those and various other likely spots has not yet disclosed this small Crucifer from any Somerset locality beyond the Avon bank; and yet the species is intermittently spread from Yorkshire to Bristol and Pembroke. It is remarkably distributed on the continent, and recorded from N. Africa to western Asia.—H. STUART THOMPSON.

REVIEW.

The Trees, Shrubs, and Plants of Virgil. By JOHN SARGEAUNT. Oxford: B. H. Blackwell, 8vo. cl. pp. vii, 149.

IN speaking of this modest but pleasant and pleasantly turned-out little book, we feel an uncomfortable sense of likeness to a topsy-turvy Balaam. It is no pleasant task to pick holes in the work of a scholar who loves his plants, loves Virgil and the fair land of Italy, which he seems to know in all its length—he speaks familiarly of the hills of Bologna, of Taranto, of Sicily, and even of the Ionian coast between Cotrone and Capo Nau, trodden by few foreign and even fewer Italian feet, other than those who earn their daily bread on those desolate shores.

The subject is approached in the right spirit by pointing out that Virgil had a native power of observation, combined with a young man's passion for the beautiful language of the Greek pastoral poets—tendencies not always in accord; the literary influence prevails, for "Virgil seems at times" [we should say, oftener than not] "to think less of the objects with which he deals than of his desire to reproduce in the graver, not to say heavier, language of Rome the beauties of the Sicilian poets." But this point of view is not always maintained in the attempt to identify nearly all the poet's plant-names with definite species, for the most part natives of Italy.

Although Virgil owned a small estate near Mantua, where he was born, we must not, except in certain cases, look for his plants in northern Italy. The Georgics were—at least in part—written at Naples, where he is said by Macrobius to have learned Greek as a young man; he had accompanied Horace on the famous journey to Brindisi before the Georgics were begun, and he saw with his own eyes the more brilliant flora of Greece. Nevertheless, his flora, like his agriculture, when not a mere echo of Theocritus or other Greek poets, is certainly that of Central Italy. It is impossible to say how much of the farming of the Georgics is described from Virgil's own knowledge, and how much is taken from those shrewd old writers *De re rustica*, Cato and Varro. Cato's home was at Tusculum, on the eastern spurs of the Alban hills, whilst Varro had an estate near the same place and another at Cumae: hence they describe farming as practised in central—not in northern or southern—Italy, a limitation confirmed by the internal evidence of their writings. Columella's fuller treatise, on which commentators chiefly rely to interpret the Georgics, is later than Virgil's own works.

But we cannot confine the plants of Virgil, as distinct from his agriculture, to the native flora of Italy alone. We must search for them among those known to his model, the Sicilian Theocritus, and above all among those commonly grown in Roman gardens of the time. And here, if Roman taste were similar to that of the modern Italians, we shall expect to find that scent—sweet, aromatic, or pungent—was the chief attraction. The high esteem in which scent was held may explain the use of the name *Viola* for the sweet-scented stock as well as for the sweet violet, which to us seems so strange a confusion of unlikes.

We fear that Mr. Sargeaunt's book falls between two stools; it is not thorough enough for the botanist, who wants bibliographies and references and evidence of the determinations laid down; whilst for the non-botanical reader, to whom plant-names convey no connotation, the accounts of the species are not clear and striking enough to convey distinct ideas—indeed, to make Virgil's flora thoroughly intelligible to such readers nothing short of figures of some kind would suffice.

Exclusive reliance on Arcangeli's handbook for the distribution of Italian species and for their modern names has resulted in not a few errors as to the former, and to one or two absurdities in the latter, as when *Pino di Scozia* (Scotch fir) is given as the Italian name of *Pinus silvestris.* The reader must be warned that the Tuscan popular names given by Arcangeli and for the most part taken from Targioni-Tozzetti's *Dizionario Botanico* are not only not current, but would be unintelligible in the greater part of Italy. A graver fault is the lack of distinction between determinations that are practically certain and others that are only probable, or sometimes very doubtful. For instance, *Baccar* is unhesitatingly identified with *Cyclamen europæum*: this is the opinion of Bertoloni, who says that in the hills of Brescia that species is known as *baccare.* On the other hand, *beccare* and *beccaro* are used of other plants—e. g., *Specularia Speculum*, Venus' Looking-glass—in other districts. The word is obviously the Greek *βάκκαρις*, of which Dioscorides says that it is *θαμνώδης, εὐώδης καὶ στεφανωτική.* Pliny's chapter on *Baccar* shows that he did not know what the name really meant. Perhaps the ancients like the moderns used it of sundry quite unrelated plants, and it is a matter of pure speculation what Virgil intended, if indeed he intended anything more than to introduce in his verse a sound like that of a musical Greek word.

Cytisus is usually, as in this book, taken to mean *Medicago arborea.* This, however, is a rare shrub in Italy, thought by Fiori (in Fl. Anal. d'Italia) only to exist there as a naturalized alien, which may account for Mr. Sargeaunt's not having been able to find any common Italian name for it. Even beyond the Adriatic it is not abundant. In Lemaire's edition of Pliny, vol. v. (1829), there is an *excursus* of ten pages by Desfontaines on the question, deciding, though inconclusively, for *Medicago*; but probably the safest opinion is that of Bertoloni—"de quo Cytiso loquatur (Virgilius) dictu difficile, nec concordant interpretes. Sive vero pertineat ad Cytisos nostros, sive ad Coronillas, Medicagines aut Lotos clare patet agi de planta in pascuis obvia"—which *Medicago arborea* is not.

Hyacinthus, whether in this Latin form or as the Greek *ὑάκινθος*, has always been a puzzle. The original meaning seems to have been one or more kinds of *Scilla*; then the worship of Dionysus transferred the name to the plant of Theocritus, the petals of which bore the marks AI AI. We cannot abandon the old identification of this with the Larkspur, *Delphinium Ajacis* (accepted by Sir W. Thisselton Dyer in his contribution on "Flora" to the *Cambridge Campanion to Greek Studies*) in favour of Mr. Sargeaunt's not very happy suggestion of *Gladiolus segetum*. Virgil's use of *Hyacinthus* seems to be merely literary, not botanical.

Whilst in many cases there is no doubt about the genus to which Virgil's plants belong, we must protest against our author's habit of selecting a particular species without special evidence in its favour, when others of the same genus are equally wide-spread in Italy. Take for instance *Caltha*, *Carduus*, and *Carex*. Why must *Caltha* be the garden marigold from Africa only, when the fields in south Italy are golden with wild marigolds, which in Sicily are of several species? *Carduus* must be taken to mean any common thistle such as an Italian peasant would call *cardone*, whether a true *Carduus* or not. The farmer's worst enemy is not, as in England, *Circium arvense*—*C. lanceolatum*, *Galactites tomentosa*, *Scolymus hispanicus*, *Cynara horrida* and several spiny Centaureas are among the most troublesome—nor should *Carex* be restricted to *Carex acuta*.

The oak is very inadequately dealt with. The statement that modern botanists refuse specific rank to the two forms of English oak represents an opinion that is quite out of date. The remark about Pliny's *Robur* on p. 109 is extremely misleading. Pliny's oaks are six in number; "glandem ferunt robur, quercus, esculus, cerrus, ilex, suber," to which he adds *ægilops* later on. He does not identify *cerrus*, the Turkey oak, with *robur*, as Mr. Sargeaunt says. One of the finest Italian oaks bears the name of *Quercus Virgiliana*: it has edible acorns, and is known to woodmen as *quercia castagnara*.

Olea, too, is not very satisfactory. The olive flowers in June—in Calabria and Sicily as early as the end of April, not in August; but the olive is too large a subject to enter on here. Under *Taxus* we might have been reminded how Cæsar tells us that Cativolcus, king of the Eburones, poisoned himself with yew, "cujus magna in Gallia Germaniaque copia est." It will be noticed that when speaking of *Aconitum* the author forgets that *A. Lycoctonum*, or its variety *neapolitanum*, is plentiful in the higher parts of the Apennines, especially towards the south. Perhaps it is just because this species as well as *Anthora* and the blue kinds are confined to the mountains that Virgil could speak as if there were no aconite in Italy. Then it is hardly fair to give *visciolo* as the Italian equivalent of *Cerasus*: the cherry is universally known as *ciliegio* in Tuscany and as *ceraso* in the south; *visciolo* would not be generally understood, and is only to be used in a special sense. Though it is true that in many parts of the country *Ferula* is absent or rare, yet it thickly covers many miles of the Apulian plain. The account of *Helleborus*, though correct, is so obscurely worded that the non-botanist might suppose that Linnæus had given this name to the genus *Veratrum*! As for *Myrica*, *Tamarix africana* is just as plentiful as *gallica* on the southern and Sicilian coasts. *Thymum*, as we are told, probably included both *Thymus vulgaris* and *Thymus capitatus* to the exclusion of *Serpyllum*. The thyme of Tarentum praised by Horace as equal to that of Hymettus is identical with the Attic in scent and flavour, which depend on the profusion of *Thymus capitatus* and *Satureia cuneifolia* on the rocky hills, but nowhere is *T. vulgaris* of the western coast plentiful enough to be the predominant honey-flower. In the case of *Crocus* Maw's monograph would have been a better guide than Arcangeli.

There remain a few real "howlers" that we cannot pass over. The Italian name for the silver fir, *Abies pectinata*, is *abete bianco* not *abete rosso*, which is the spruce and does not extend to the Apennines. *Acanthus mollis* is not "a scrofularious plant," but gives its name to the order *Acanthaceæ*. Under *Cupressus* the language implies that Theophrastus was wrong in believing the cypress to be native in Crete. Theophrastus was right: in the mountains of Sphakia in southern Crete it forms a forest between 2000′ and 4500′, which is easily seen in clear weather on the voyage from Taranto to Port Said as a dark patch on the mountains. Under *Laurus* we are told that "the true laurel is the bay—*Laura nobilis*—from which we get camphor and cinnamon": those products would be less expensive if the statement were true. It is a cruel trap for the general reader who may not know that the genera *Camphora* and *Cinnamomum* (in which *Camphora* is now included) belong to the order *Lauraceæ*. Of *Medica* we read "its name of *μηδική* refers to a supposed Persian (sc. Median) origin, but I do not find that it occurs in Asia either wild or cultivated." Did it not occur to the author to consult Boissier's *Flora Orientalis*, where he would find Lucerne quoted from Bithynia, Galatia, Lycia, the Taurus, Lebanon, Armenia, the eastern Caucasus, northern and southern Persia, Afghanistan, and Beluchistan? *Pinus halepensis* (misspelt) is said on p. 102 to be the dominant pine on Mount Ida: if Ida of the Troad is meant, the dominant pine there is the Corsican (*Laricio*) not the Aleppo (*halepensis*), which is an inhabitant of the coasts and lower hills of the eastern Mediterranean, but does not climb up to the mountains.

In spite of such blunders the many gossipy digressions and quaint observations make this little book attractive, but it cannot become the much-needed standard key to an understanding of Virgil's Flora. Probably a definitive judgement on many of Virgil's plants will always be impossible; an accurate and accessible study of Pliny's botany would be the first step. If Mr. Sargeaunt would undertake such a work and then rewrite his Virgilian handbook, he would do a service to modern plant nomenclature as well as to classical study.

C. C. L.

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In view of the fact that the stock of these is in some cases practically exhausted, the attention of our readers is directed to the list which appears on the following page. Old subscribers of course already possess the matter contained in them in the pages of the *Journal*; but some of them appeared several years ago, and recent subscribers will thus not possess them. Some, which do not appear in the list, are already out of print; of others very few copies remain, and it will of course be impossible to reprint them: among the latter may be mentioned Mr. Dallman's *Notes on the Flora of Denbighshire* (1911), and Mr. Bennett's *Supplement to 'Topographical Botany.'* Of the Supplements to the *Biographical Index* no complete sets remain. It had been hoped before this to issue the second edition of the work, in which these Supplements are of course incorporated, but the present cost of paper and labour has rendered this impossible. Of the *Index* itself no copies remain, these having been lost in the course of transferring the stock to Messrs. Adlard. Mr. Garry's *Notes on the Drawings of Sowerby's 'English Botany,'* containing, as it does, much topographical information and numerous unpublished notes by Smith, Sowerby and others, should be in the possession of all interested in the history of British Botany: only sixteen copies remain.

It may be pointed out that, although for the most part relating to British Botany, certain of the reprints have a more general appeal. Such are the *Index Abecedarius*—a list of the plants in the first edition of Linnæus's *Species Plantarum*, showing at a glance what are included in that work, which has no index of species; the *History of Aiton's 'Hortus Kewensis,'* which contains much information as to the authors and contents of that classical work; the *Flora of Gibraltar*, which, besides a complete list, contains notes on the more interesting species; Linnæus's *Flora Anglica*—the first English Flora—has a bearing upon nomenclature: of all these there are numerous copies.

[*Over.*

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No. 695 NOVEMBER, 1920 Vol. LVIII

THE JOURNAL OF BOTANY

BRITISH AND FOREIGN

EDITED BY

JAMES BRITTEN, K.C.S.G., F.L.S.

LATE SENIOR ASSISTANT, DEPARTMENT OF BOTANY, BRITISH MUSEUM.

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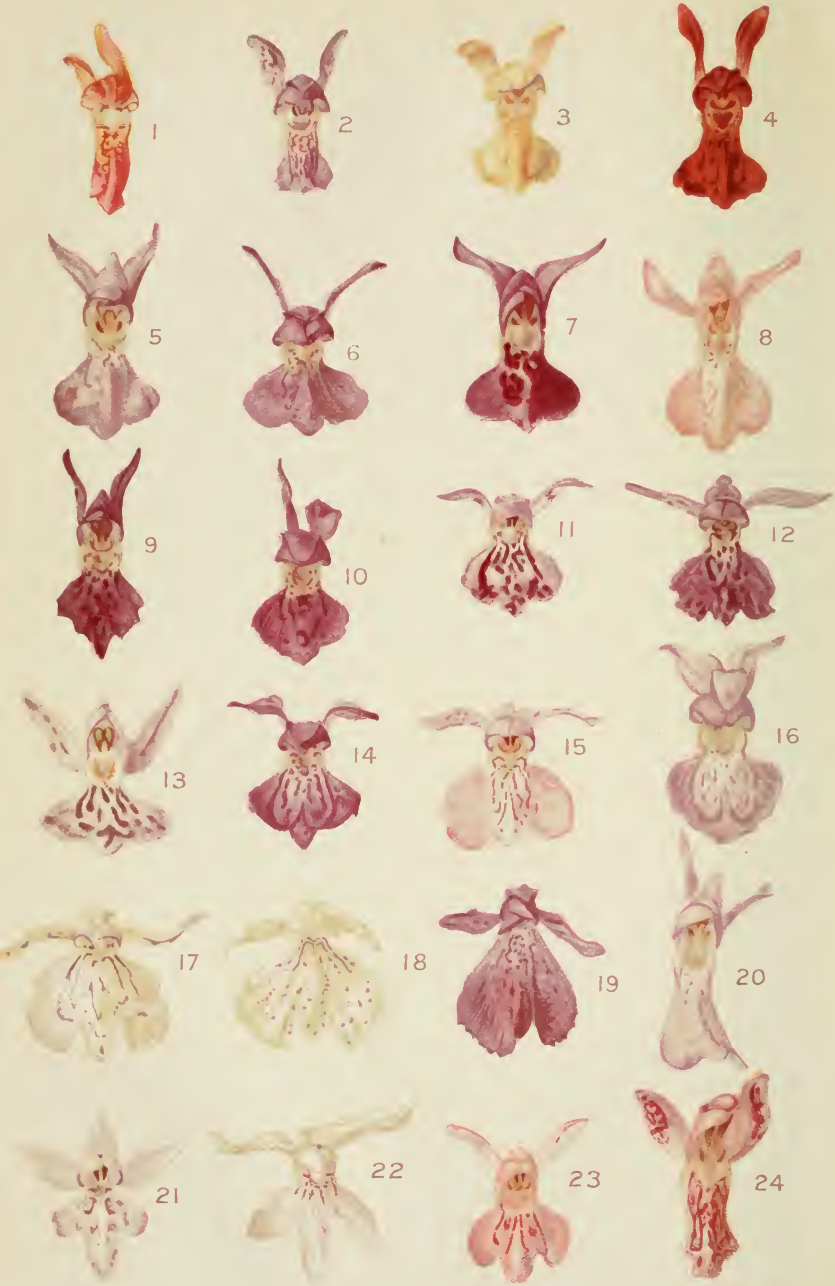
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Flowers of Marsh and Spotted Orchids, enlarged.

THE BRITISH PALMATE ORCHIDS.

By Rev. T. Stephenson, D.D., and T. A. Stephenson, M.Sc.

(Plate 556.)

The present contribution is offered as a summary of the result of several years' work on the Marsh and Spotted Orchids, and to explain the accompanying Plate. We hope to amplify it in the case of some of the forms in later issues.

The decision resulting from our work is that, although the forms in question run into each other very much, they are not a hopeless tangle, and it is quite possible to recognize certain definite *landmarks* or *species* among the mass of forms, and to detect many intermediate *hybrids*. This does not controvert the fact that a series of intermediates between some of the species is found, but a little careful study reveals very definite types.

According to our idea the British Palmate Orchids comprise the six following species:—*O. incarnata* L., *O. purpurella* Stephenson, *O. ericetorum* Linton, *O. prætermissa* Druce, *O. latifolia* L., *O. Fuchsii* Druce *.

O. incarnata can always be clearly recognized from its sword-like, never-spotted leaves and its unusually *small* flowers with very stout spur, stiffly erect sepals, and lip as a rule longer than wide, reflexed, not deeply lobed, and with a pattern almost always composed of definite lines inside a single more or less continuous enclosing boundary-line. The exact form of lip and leaf is variable, but the whole plant is unmistakeable. The flower may be white, pale yellow, pink and yellow, mahogany-red, deep crimson, rose-pink, light or dark purple. The habit is dwarf or tall, the leaves are broad or narrow.

O. prætermissa has been a good deal criticized, but it is, in our opinion, a perfectly good species, and cannot be confused with O. incarnata. The flower is always purple or crimson-purple of some shade, lilac, or white. The lip is typically broader, flatter, and larger than in *O. incarnata*, and in the type-forms has a less definite and strong pattern, often of small dots, and a somewhat less stout spur. There is, however, a form common in the north more particularly, in which the flower-colour is red crimson-purple, the lip-pattern heavier, and the lip may be somewhat diamond-shaped—this is a very distinct form, and there seems to be a somewhat similar variety distinguishable in *O. incarnata*, the v. *pulchella* of Druce (see J. B. 1920, p. 166). The leaves are never spotted in *O. prætermissa*, and are less sword-like than in *O. incarnata*. This species is evidently considered by some botanists to be typical *O. latifolia*, but to that we will refer later.

---

* We use the names *ericetorum* and *Fuchsii* rather than *ericetorum* and *maculata* simply to avoid confusion, because different botanists will take the word "*maculata*" to mean quite different things. We prefer to use the name *maculata* as a general term of reference to both, an aggregate species-name. We will refer to this later in more detail.

O. PURPURELLA is fully described in this Journal for July last (p. 164). The plant is more or less dwarf, and, save in exceptional cases, which are few, the leaves are spotted either all over or only at the tip (sometimes the tips of only the upper leaves) with little dots—never rings or blotches. The flowers are deep crimson-purple with very stout spur and more or less diamond-shaped flat lip with a pattern which is fairly heavy, but less regular than that of *O. incarnata*. There are several considerations which convince us that this is a genuine species and not a hybrid:—

(*a*) In the first place it appears to be extremely constant in each locality in which it occurs. In the spot best known to us it grows vigorously and seemingly in increasing numbers, and with less individual variation than in the case of any other species in the group. Always the plants are short, the leaves with their very small dots, the lips diamond-shaped, and the flowers of rich deep crimson-purple.

(*b*) None of these points suggest a hybrid origin. In a hybrid between one form with and one without spotted leaves there is a good deal of variation in every case known to us—some plants have rings on the leaves, some blotches, some large and some small spots. The lip also is a combination, in a hybrid, of those of the parents. The clean-cut diamond of *O. purpurella* is not derived from any possible combination. Its deep brilliant colour, again, points in the same direction, for if it were a hybrid one would expect dilution of colour, whereas in reality it has the richest tint of the whole Marsh Orchis series. A further consideration is this, that wherever *O. purpurella* grows it hybridizes with other forms, and these hybrids are more distinct and easy to identify than those of other species. The rich colour of the *O. purpurella* parent is transferred to the hybrid a little diluted—in the hybrid *O. purpurella* × *ericetorum*, for instance, the colour is at best a magnificent brick-red-purple which could come from nothing but *O. purpurella*, and needs to be seen *in situ* to be realized at all. The *form* of the lip in these hybrids is intermediate between that of *O. purpurella* and the other parent, be it *O. latifolia*, *O. ericetorum*, or *O. Fuchsii*.

(*c*) The above-mentioned considerations preclude any identification with *O. latifolia*. Our reasons for resisting identification with *O. cruenta* were given in the paper on this species in the July issue this year. An additional point is mentioned by Col. Godfery in correspondence—viz., that *O. cruenta* is described in some Continental Floras as very heavily spotted, having spots on *both* sides of the leaves.

O. LATIFOLIA will be the subject of a short paper later on, where we shall give our reasons for thinking that it really is a species and not a mass of hybrids. It has many forms, some of them approaching other species to some extent, but usually has spotted or blotched leaves, the spots being often ring-shaped. The flowers vary from white or pale lilac to dark purple, the lip is broad and flat with slightly incurved edges, fairly neatly trilobed, and nearly always with a heavy *line* pattern. Spur always stouter than in *ericetorum*, but variable—may be very stout. Sepals erect, but often less rigid than in *O. incarnata* and *O. purpurella*.

O. ERICETORUM is very variable, but cannot be confused with any Marsh Orchis unless it be a pale specimen of *O. latifolia.* Leaves usually narrow and keeled, but may be broad, spotted or blotched, or unspotted, only with rings as a rare exception. Stem solid *. Flowers nearly always with spreading or drooping sepals, slenderer spur than in any other form, and broad lip which is sharply 3-lobed, but with the central lobe very much smaller in area than the lateral lobes and often shorter than they are. The flower may be white, lilac of various shades, pink, or light purple, and there are darker markings on the lip as a rule, which may form almost any conceivable pattern of either dots or lines.

O. FUCHSII has the leaves typically blotched or unmarked and often flat, the lower leaves usually broad, and the lowest of all with a blunt rapidly-narrowing end, a contrast to the more gradual tapering typical of *O. ericetorum.* Flowers with fairly slender spur, sepals spreading to fairly erect, lip sharply cut into three *subequal* lobes by deep clefts. At its best the lip has the middle lobe about equal in area to the side-lobes. The flower-colour is white or lilac or light purple with darker markings, which, although they frequently make a rather regular little pattern of lines in the middle of the lip, may extend over its whole surface as they so often do in *O. ericetorum.* A very distinct race of *O. Fuchsii* with pure white flowers and unspotted leaves occurs in Ireland and Scotland, which Druce has named *O. O'Kellyi.*

With the above preface we may proceed to the description of our Plate, which will supplement the former paper on *O. purpurella* and illustrate any later ones on Marsh Orchids. It is not easy to describe these critical forms in words, and we hope the Plate will clear up our meaning. Leaf-schemes we had prepared, but cannot, unfortunately, print them.

EXPLANATION OF PLATE.

The figures on this Plate are not all drawn to quite the same scale, so should not be compared with each other from that point of view. They are done, however, with great care as regards *proportions*, form, and markings of each flower. Allowance should be made for some loss of depth and brilliance in some of the colours due to reproduction.

Figs. 1–4 and 24. O. INCARNATA. These show the narrow, more or less reflexed lip, small in proportion to the rest of the flower, and not deeply, though distinctly, trilobed; and also the characteristic pattern of lines inside a more or less continuous enclosing line in the typical forms, on the lip. Note the erect sepals and the very wide throat where lip and petals join. The colour-range is greater here than in any other species. Fig. 1 is from a Kidwelly specimen, with both dull pink and yellow in the flower. Fig. 2 is from a Cardiganshire form with purple colour. The purple in some forms is darker than this. Fig. 3 is the pale yellow form common at Kidwelly. Fig. 4 is another Kidwelly form, with flowers of a rich deep maroon or mahogany-red. This form is sometimes tall, sometimes dwarf, and when dwarf comes under the var. *dunensis* of Druce. It is possibly a crossing of this form with the pale yellow one which produces the colour shown in fig. 1. Fig. 24 (Shrewsbury) is the typical rose-pink form found in various parts of England.

---

* We may mention here that we find that the solidity or hollowness of the stem is not constant in all species. In *O. incarnata* the stem is always decidedly hollow, in *O. ericetorum* and *O. Fuchsii* it is always solid, but in *O. prætermissa* and *O. latifolia* it varies from truly hollow to quite solid through degrees where it is three-quarters or more solid with a tiny central cavity.

Figs. 5–8. O. PRÆTERMISSA. Figs. 5 (Aberystwyth) and 6 (Kidwelly) show the typical form of this species, with the lip both actually and proportionately broader than in *O. incarnata*, much flatter, and with a less distinct pattern, composed of dots and slight lines. The throat is not so wide as that of *O. incarnata*. Sepals more or less erect. Colour-range confined to the purple to white series, with variations in the direction of magenta, red, and pink, but never the curious reds and yellows of many forms of *O. incarnata*.—Fig. 7 is from a plant of a form of *O. prætermissa* from Towyn. It shows the neat flower and lip, the rich colour, and a heavier pattern than is usual in *O. prætermissa*, but which is not like that of *O. incarnata*. It should be observed that this form very decidedly comes under *O. prætermissa* from its broad flat-lip (and also its leaves), but there is also a somewhat similar *O. incarnata* var. *pulchella*, with which it should not be confused.—Fig. 8 is a pale form from Kidwelly, of which we found several examples. The lip is not so broad as in the other forms, the patterns being very typical of *O. prætermissa*.

Figs. 9 and 10. O. PURPURELLA. Fig. 9 is the Aberystwyth form, fig. 10 that from Hawkshead. Both show the erect sepals and fairly wide throat, and the purple colour. The lip-pattern is fairly heavy but irregular, and quite differs from that of either typical *O. incarnata* or *O. latifolia*. The lip itself is more definitely trilobed and less purely diamond-shaped in the Hawkshead form. It should be noted that fig. 9 shows an extreme example of the diamond, many of the flowers of the Aberystwyth form being more like fig. 10, though of richer colour; the Hawkshead form, too, may be more like fig. 9 sometimes, or in other cases verging more towards *O. prætermissa*. The rich colour of the Aberystwyth form is altogether too deep and brilliant to be rendered in paint, and the figure must be supplemented by the imagination, being as near the reality as we could make it.

Figs. 13–16. O. LATIFOLIA. Under this species there are at least six groups of forms to be roughly distinguished, although they run into each other. The Plate shows examples of four of these. All have a broad flat lip rather incurved at the edges, more or less erect sepals, and a wider throat than that of *O. ericetorum*. The typical forms have a heavy line-pattern also, be their colour light or dark.—Fig. 13 is from a slender heath-form at Aberystwyth. The *flower* of this is very like the flowers of many pale forms of the species, with a dark purple line-pattern on a pale ground. Fig. 14 is from a dark form growing on *Sphagnum* at Borth. The heavy line-pattern is clear in spite of the purple ground, and this fact holds good for most of the dark-flowered forms. Fig. 15 is from a Kidwelly plant. This shows a pale form with a slighter pattern, which is represented in many places by sets of similar plants, and has almost the appearance of a hybrid. Our experience leads us to believe, however, that it is pure *O. latifolia.* Fig. 16 (Isle of Wight) is a curious and uncommon form with large, stiff, waxy flowers with most peculiar heart-shaped lips. The pattern is regular, though not heavy. This is the most easily distinguished form we know, but it is not typical of the species as a whole.

Figs. 17–19. O. ERICETORUM. These figures show the lax sepals and narrow throat, the large flat lip with the lateral lobes much larger in area than the central lobe, but cleanly marked off from it. The colours are usually pale, and the pattern may vary to any conceivable extreme, though the plant can never be confused with any other species on that account, and the pattern is perhaps most often composed of small dots or lines, which often cover the whole lip. Figs. 17 and 18 are typical forms from Aberystwyth, fig. 19 being a curious and rather distinct form from Tregaron, which typically has pinkish-purple flowers and very narrow leaves, often unspotted, and a slightly narrower lip than usual.

Figs. 21 and 22. O. FUCHSII. Both figures are from Aberystwyth plants, and show the very deeply cleft lip with a middle lobe larger in area than that of any of the other species. The pattern is frequently of the rather regular sort shown, but may vary a good deal, and is sometimes more like those of *E. ericetorum.* Colours usually pale.

Figs. 11, 12, 20, and 23. HYBRIDS.—Fig. 11 is *O. purpurella* (Aberystwyth form) × *O. latifolia* (heath form shown in fig. 13). This shows an almost perfect combination of the parent flowers, both size, shape, and colour of lip and width of throat being intermediate between those of the parents. The heavy line-pattern is derived from *O. latifolia.* The leaves are heavily blotched.—Fig. 12 is *O. purpurella* (Aberystwyth form) × *O. ericetorum.* The influence of *O. ericetorum* is well seen in the broad crenulate lip and narrower throat, that of *O. purpurella* is the purple colour and stiffer sepals. The leaves were spotted.—Fig. 20 is probably *O. incarnata* × *O. latifolia* (Shrewsbury specimen). The reflexed lip and wide throat suggest *O. incarnata*, the large flower and spotted leaves of the plant, *O. latifolia* or *O. ericetorum.* We prefer the former because of the lack of crenulation of the lip, the *incarnata* reflexion not being much overcome. The pattern is not very typical of either parent.—Fig. 23 is *O. incarnata* × *O. latifolia* from Kidwelly. The form of the lip is due to both parents, the small size of the flower, the rosy-pink colour, and stiff blunt sepals being due to *O. incarnata.* Leaves spotted.

N.B. The hybrids in figs. 11 and 12 are found in considerable numbers at Aberystwyth, especially no. 11. Those in figs. 20 and 23 are isolated examples.

We should like to mention a few isolated points that do not fit in very well above. The Plate, of course, only includes a selection of forms, and does not in any way claim to show even all the main forms in any given species; it simply has as many as could be inserted. With regard to the hybrids, if anyone else has seen hybrids with the same parentage as those illustrated, but with quite a different appearance, this does not disprove the correctness of our identification. We find the hybrids vary very much, more than the parent species, and different proportions of the parents are found in different cases. Also the particular form of its species to which each parent belongs affects the hybrid.

We have examined the character sometimes used in classifying these orchids—*i. e.* whether the tips of the leaves are flat or hooded—and have found that no reliance can be placed on it, as it varies within the same species. Moreover, leaves may be flat and delicate or keeled and thicker in texture in the same species, according to habitat. If an *O. ericetorum* with thick but narrow and keeled leaves be transplanted into a thoroughly shady wood, the leaves become flat and delicate though remaining narrow. Similarly, specimens of *O. Fuchsii* in shade in a wood have the flat delicate leaves, those in a field in the sun have the leaves slightly thicker and more inclined to be keeled, though not as coarse in texture as those of *O. ericetorum* and not affected as to shape.

It is hoped that where our diagnosis of forms may not be accepted, the Plate will prove useful for purposes of comparison and reference.

THE LICHEN SYMBIOSIS.

By A. H. Church.

(Concluded from p. 219.)

Taking the primary somatic organization of the constituent Fungus as being hypothetically a mere formless weft of septate mycelium, and that of the algal constituent as being in the general run of cases merely discrete cocci ('gonidia') of a Protococcoid alga, with no more somatic organization than that of the Palmelloid phase (itself the negation of a 'soma'), the fact that the product of the synthesis may present form-factors of very definite character, should imply that certain factors may be ascribed to the symbiosis. Again, some general rule should be applicable to all, however much minor details in size, texture, or chemical nature of the units, might make for variations on the scheme. That is to say, if there is one 'symbiosis-factor,' it should be reflected in one type of soma. To what extent such a generalization will hold, may be discussed from the the consideration of a few of the commonest and most familiar of British Lichens. Owing to the favourable moist atmosphere of the British Isles, such types are well represented, and little is gained from appealing to any more conspicuous and divergent constructions of exotic genera.

I. For example, taking a fine form as *Peltigera canina* (including algal protoplasts as *Nostoc*) growing as beautifully-lobed and branched patches, a foot or more in diameter, the somatic organization may be expressed in terms of: (1) dorsiventrality; of (2) unifacial type; (3) lobing or proliferation; (4) ramification, appearing more or less dichotomous; (5) continued growth at the end; (6) a certain amount of intercalary extension, responsible for the broad area so readily attained; (7) marginal apothecia, otherwise of normal Discomycete category. The general organization is that of a mere blanket-type of hyphal weft, formed of felted septate hyphæ, 10–12 μ diam. Beyond the normal production of ascospores in apothecia on marginal lobes or ramuli, three or four undoubted form-factors may be isolated, without straining, as calling for comment or explanation as to the causes which may have produced them as part of an elaborate physiological mechanism.

II. From such a type *Physcia parietina*, the common yellow crustaceous lichen of slate-roofs, with included *Cystococcus*, differs only in adding dorsiventral *bifacial* construction, as the peripheral pseudoparenchymatous weft is differentiated on the lower surface of the thallus as well, inhibiting the extensive rhizine-system of *Peltigera*, and suggesting a further xerophytic adaptation and control in terms of a far more substantial pseudoparenchymatous screen. Otherwise there is no special ramification beyond a mere peripheral lobing of the thallus-margins. That is to say, taking such types of dorsiventral and crustaceous lichen only, there seems much to be said for the new somata being much alike, since with different Fungi and different Algæ, the form-factors present much in common.

III. But in the case of *Usnea barbata* one finds a thallus of quite a different type, presenting factors of (1) centric, or radial organization; (2) copious ramification; (3) any lateral may extend as a leader, without rule, or remain a short filamentous process; (4) the ramuli show apical growth and differentiation; (5) intercalary extension is restricted; (6) the internal differentiation of an axial strand of hyphæ, mainly parallel in direction, of skeletal value, may be distinguished from (7) the loose weft of the cortex, with again a dense and continuous peripheral tract of pseudo-parenchyma; (8) broad apothecia with normal details terminating special ramuli as in *Peltigera*; the whole organization a well-marked branching 'fruticose' type, attached by a definite hapteron of hyphal filaments, as a bushy type of growth which may attain a length of a foot or more in associated species, presenting so close a copy of an autotrophic plant-form that one forgets to remember that it is merely a product of a dual 'synthesis.'

IV. *Cladonia sylvatica*, again, as a minor variant on the bushy growth of the Reindeer Moss (*C. rangiferina*, erect and as much as 1½ ft. high), presents a similar miniature 'arboreal' habit, as a fruticose ground-form, with main trunk and laterals; but (1) the main axis is hollow, and has no skeletal strand, also it may be perforated locally, as at the axils; the primary laterals are somewhat irregularly spaced, though more definitely in acropetal series; ultimate ramuli acquire a more or less dichotomous habit, which may be very pronounced in minute end-ramifications on which the apothecia are borne. Lateral systems, again, may take on a distinct unilateral or drooping habit: the larger types are bushy masses 1–1½ ft. high.

Even in the case of the so-called *podetia* and scyphus-cups of other species (*C. pyxidata*) no advance is made by regarding these as part of a special fructification; since one does not get away from the fact that any axis, in which even ascogenous hyphæ may ramify, is still a part of the gametophyte mycelium; and, as in the case of a long-stalked *Peziza*-cup, the radial or centric organization of a massive axis is the point that requires explanation.

Without going into other complex somatic forms of Lichen, such as the branched perforated framework of *Cladonia retipora* or the beautiful series of whorls of the radially-organized *C. verticillata*, it begins to emerge that the lichen-soma is extremely variable; the symbiotic factors are by no means conformable; no factor of symbiosis, for example, can explain why an *Usnea* should be radial and *Peltigera* dorsiventral, why *Cladonia* is tubular and *Usnea* solid; yet if these are evolutions *de novo*, there must be some sub-aerial cause for this divergence since the initiation of the first synthesis, however much these somatic factors may be now inherited. It is for the lichenologist to trace the meaning of every factor. Scientific botany consists in the analysis of the plant-organism, step by step, referring each factor to its physiological origin and function in the economy of the organism. Wholly gratuitous hypotheses of mere adaptation to light-supply, for example, in the dorsiventral *Peltigera* will not explain the centric habit of *Cladonia*, growing similarly on the ground among grass, and both dry up equally on desiccation to recover flexibility on wetting. The analogy of 'stem' and 'leaf' of higher land-flora, as if lichens were physiologically 'imitating' the morphology of higher autotrophic vegetation, is of course the solution of the problem commonly and ingenuously put forward (Sachs, *loc. cit.*); but the significance of the evolution of even the factors of 'stem' and 'leaf' in the land-plant is not completely explained, except as facts of observation, crystallized in academic morphology, until it is no longer clear which comes first[1]—and such factors are often expected to come 'by nature.' But things in biology do not 'come by nature'; it is the object of the science to find out what exactly is meant by 'nature,' as also by 'coming.' That the appearance of such factors presents little difficulty to the imagination of those who have followed the progression, similarly wholly *de novo*, of the land-plant from an antithetic, interpolated sporophyte—as a spindle-shaped embryo, throwing out enations to be sterilized in terms of leaves and sporophylls[2]—may be freely admitted; and such minor points as the distinction between a dorsiventral crustaceous thallus and a radially symmetrical multibranched axis, may appear merely trivial. But all these factors have to be accounted for. The study of lichen-morphology does not account for them, but again accepts them as facts of observation. Really they should be the most critically explored features of the whole subject—if, as asserted, they arise *de novo* in a dual symbiont, in direct response to the same environment of light-supply, water-supply, gas-supply, and food-salt supply. Why, for example, should the *Parmelia* and *Usnea* consortia both grow on the bark of trees, or those of *Peltigera* and *Cladonia* both among grass, and yet be so widely divergent in their new factors? The only factor that appears to be common to all is the differentiation of a close weft of pseudo-parenchyma as a screen over the tract of dissociated photosynthetic algæ; and even this is not always done in the same way [cf. *Ephebe* and the fine thalloid shoots of *Rocella fuciformis*; wholly wanting also in many genera (*Crocynia*) or more clearly simulating an aqueous epidermis].

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[1] Bower, *Origin of Land Flora*, p. 251 (1908), 'Stem and Leaf.'

[2] *Op. cit.* p. 142.

One begins to doubt the symbiont partnership as having anything to do with the matter, though one may be put off with the idea that the range of variability in such a 'nascent,' and hence 'labile' organism (Reinke, 1895, p. 69) initiating new departures, may be excessive; just as Sachs (*loc. cit.*) put it all down to the chlorophyll. Perhaps the somatic organization is not so very new after all: even among Ascomycetes of holosaprophytic habit very striking growth-forms may still be retained; the case of *Xylaria polymorpha* with bilateral, erected, stromata, branched more or less irregularly or dichotomously at the distal end, and bearing indefinite 'cystocarpic' perithecia in its cortex, presents suspiciously comparable form-factors. And one's doubts are confirmed when a little consideration shows *that not one of these factors is anything new after all.* They are, in fact, only a repetition of the commonest of commonplace factors of the somatic organization of algæ, as seen in modern seaweeds, in which centric cable-stranded axes, hollow, or with skeletal axial strand—or, again, dorsiventral shoot-systems attached by rhizoidal processes, indefinite in ramification, or proliferating subdichotomously, with differentiation of a dense 'cortical' layer, more or less protective against intrusion—are the prevailing methods of somatic elaboration. Again, *these and no other*, in similar filamentous wefted growth-forms ('cable-strand types of aggregation'), are the working mechanism of Green (Siphoneæ), Red (Florideæ), and Brown (Phæosporeæ) algal phyla of the sea. For example, the building of massive radially symmetrical axes, with preferential apical growth, and capacity for throwing out laterals of similar organization, repeating the construction, *is* a mechanism involving numerous controlling form-factors, each of which can be only established in marine organism as response to changes in a certain environment by rigorous natural selection. So far as known, such factors of organization can be only evolved in the conditions of marine phytobenthon, consequent on the attachment of encysted plankton-flagellates to a substratum within the range of light-penetration. It is to the sea that one must look for the analogue of any specialized lichen-thallus; and a glance over the pages of any set of illustrations of lichen-types at once discloses their essential morphological identity with forms of autotrophic marine organism, more particularly in the manner of Floridean types of somata, as the small, clustered, or encrusting growths of reef-pool formations. That is to say, since a seaweed can only arise in the sea, as the response of autotrophic life to special benthic conditions in sea-water, the presumption is that any plant presenting similar somatic characteristics must have arisen in the sea also.

The resemblance of such plants, both in general size and shoot-construction, to depauperated sea-weeds is so striking that it cannot be blinked in the case of the finer types of the Lichen-series. Though minute and microscopic forms may show fewer characteristics, there are also many equally reduced relics of Florideæ and Phæophyceæ in the sea which retain little special somatic organization. It is to the finest and most complex types that one must look for the culminating expressions of response to the environment which has produced them. Decadence and extreme impoverishment prevail in tide-pool vegetation, and every grade of rudimentary organization that is not necessarily 'primitive' may be found in the sea; while the very mode of life of a lichen implies the added precariousness of existence, as inclining the organism to all ultimate phases of somatic degradation. Admirable illustrations are given by Reinke (Prings. Jahrb. xxvi., xxviii.)—there is no need to multiply types: a dozen will suffice, cf.:—*Cladonia furcata* (xxvi. p. 505), *C. retipora* (p. 506), *C. verticillata* (p. 509), *Lecanora esculenta*, *L. fruticulosa* (xxviii. p. 372), *Ramalina Eckloni* (p. 378), *R. farinosa* (p. 379), *Parmelia reticulata* (p. 383), *P. hottentotta* (p. 384), *P. arizonica* (p. 385), *Cetraria glauca* (p. 389), *Evernia furfuracea* (p. 392), *Usnea Taylori* (p. 396), *Sticta latifrons* (p. 441).

Reinke (1895), as an algologist, naturally recognized the many striking points of similarity in external morphology to quite ordinary types of Florideæ, even including calcified forms as Lithothamnions. His conclusions, however, that such growths will illustrate the parallel progression of plant-somata in response to the same physiological problems, affords an admirable example of utilizing conceptions of homoplasy to beg the question. There is, in fact, little identity of biological factors or physiological mechanism in the case of a lichen growing on a rock exposed to air and a submerged alga of the sea. According to Reinke (1895, p. 100) the principles to which the Lecidean type of thallus affords the response are suggested as:—

(1) The form and structure of the consortium in relation to CO_2-metabolism.

The protection of the gonidia (from desiccation—certainly not from starvation or death by exhaustion).

(3) The formation of reserve-storing tissue.

On the other hand, the sea-weed soma has little reference to these factors, since (1) the CO_2-metabolism of the sea is on an entirely different footing as regards both amount and quality of the light and gas-supply; (2) the xerophytic factor is wholly wanting, and there is no question of protection from desiccation in the sea; (3) stores of reserves may be illusory, just as algæ may accumulate large amounts of polysaccharide and carbohydrates of sorts merely as the expression of *starvation* for lack of nitrogen.

The sea-weed soma represents the response of autotrophic life to such factors as (1) surface-exposure to the external medium and light of as many photosynthetic units as possible; (2) mechanical efficiency in avoiding the drag of a moving medium. Laminate expansions and systems of ramification represent the means of supplying the former; texture, cohesion, and strength of axes the latter. Marine algæ are also filamentous, gelatinous, massive, or calcareous; such types of soma being the response to special conditions of marine environment. There is no means of conceiving the origin of even a filament of mycelium, except as originating in aqueous environment, and the sea is the original watery solution holding the food-supplies. Even a filamentous soma must have a long marine ancestry behind it. If Lichens present the form-factors, filamentous growth, not to mention reproductive phases and a life-cycle, still characteristic of sea-weeds, the presumption is that they inherit this somatic equipment directly from marine algæ; and such features of equipment are retained (though more or less open to deterioration) since they have proved useful, in the long run, or at any rate not injurious, under new subaerial conditions. The adult lichen-thallus is now a heterotrophic fungus-soma to which intrusive algæ have been added, and is not to be judged by early stages of 'synthetic' development, merely because it can no longer exist without its algal helots; any more, apparently, than can many orchids without their attendant mycorhiza—and the 'consortium' is a picturesque myth.

Lichens thus present an interesting case of an algal race, deteriorating along the lines of a heterotrophic existence, yet arrested, as it were, on the somatic down-grade, by the adoption of intrusive algal units of lower degree to subserve photosynthesis (much in the manner of the marine worm *Convoluta*). Thus arrested, they have been enabled to retain more definite expression of more deeply inherent factors of sea-weed habit and construction than any other race of Fungi; though closely paralleled by such types as *Xylaria* (Ascomycete) and *Clavaria* (Basidiomycete), which have followed the full fungus-progression as holosaprophytic on decaying plant-residues.

There can be little doubt that such a view will enlarge one's conception, not only of the remarkable history of these often despised fungus-races, as compared on one hand with the surviving Florideæ of the sea, and on the other with the great range of Ascomycetous phyla; but also it must throw light on the general problems of the changes of biological environment, which may have been effective in such a striking response, as included within what has been termed the period of the subaerial transmigration.

ALABASTRA DIVERSA.—PART XXXIII*.

By SPENCER LE M. MOORE, B.Sc., F.L.S.

(Continued from p. 226.)

3. MISCELLANEA AFRICANA (*cont.*).

ASCLEPIADACEÆ.

Batesanthus intrusus, sp. nov. Planta glabra, *caule* volubili distanter folioso uti inflorescentia saltem in sicco fusco-purpureo; *foliis* amplis petiolatis ovato-cordatis breviter acuminatis apice acutis utrobique pallide nitidis papyraceis; *paniculis* axillaribus pedunculatis foliis circiter æquilongis laxe plurifloris; *pedicellis* minute bracteatis quam flores longioribus; *calycis* segmentis parvulis del-

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* Types in the National Herbarium.

toideis margine microscopice ciliolatis; *corollæ* basi intrusæ lobis ovatis obtusissimis quam tubus abbreviatus multo longioribus; *corona* obscure annulari addito lobulo parvulo subulato patente e basi filamentorum oriundo; *antheris* apice connatis oblongis quam filamenta longioribus; *stylo* ab antheris facile superato.

Yaunde, Bitye, on ground out of cultivation; *Bates*, 1392.

Folia (lamina) 13–15 × 6–8 cm., in sicco supra fusca subtus griseo-viridia, glandulis translucentibus microscopicis copiosissime induta; petioli validi, ±2 cm. long. Stipulæ reflexæ, circiter 4 mm. long. Paniculæ patentes, 10–15 × 5–7 cm. Pedunculi ±5 cm. long.; hujus rami subdistantes, patentes, ±2·5 cm. long.; pedicelli 5–7 mm. long. Bracteæ fugaceæ, ovatæ, circa 1 mm. long. Calycis segmenta circa 1 mm. long. Corolla extus viridis, intus fusco-purpurea, pansa modo 15 mm. diam.; hujus lobi 6·5 × 5 mm. long. Coronæ lobuli ·5 mm. long. Filamenta crassiuscula, ·5 mm. long.; antheræ 1 mm. long. vel paullulum ultra. Pollinia bipartita, ambitu rhombica, acuta, in toto ·7 mm. long. Ovarium ovoideum, ·8 × 1·25 mm. Stylus alte bipartitus, lobis oblongis, truncatis, ·5 mm. long.

Foliage and inflorescence of *B. purpureus* N. E. Br., from which, irrespective of the different floral structure, it can be told on sight by the much smaller flowers. Mr. N. E. Brown, who was kind enough to examine a flower for me, directed my attention to the intrusion of the base of the corolla, a character very unusual in *Asclepiadaceæ*, so much so that he can recall only one similar case among African species.

It should be noted that, when dried, the flowers appear to be mostly unopened buds; this is due, as Mr. Bates notes, to the short time the corollas remain expanded.

Anisopus Batesii, sp. nov. Planta volubilis; *ramulis* gracilibus crebro foliosis glabris; *foliis* petiolatis oblongo-ovatis breviter acuminatis basi rotundato-cordulatis utrobique glabris necnon leviter nitidis; *umbellis* axillaribus subsessilibus paucifloris; *pedicellis* filiformibus flores excedentibus; *calycis* segmentis ovato-oblongis obtusis margine ciliolatis; *corollæ* vix medium usque divisæ tubo campanulato lobis ovatis obtusis intus subtiliter velutinis; *coronæ* phyllis ext. prominentibus linguæformibus breviter villosis phyllis int. superne liberis rotundatis integris gynostegio brevioribus; *stylo* exserto apice robusto leviterque bifido.

Yaunde, Bitye; *Bates*, 1300.

Folia usque 10 × 5 cm.; pleraque vero 4–7 × 2–3·5 cm., in sicco læte viridia; costæ laterales ut reticulum pag. inf. mediocriter visibiles; petioli tenues, 6–20 mm. long. Umbellæ ±6-floræ. Pedunculi validi, minute bracteati, circa 2 mm. long. Pedicelli ±10 mm. long. Flores atropurpurei, in sicco 8 mm. diam. Corollæ tubus 4 mm., lobi 3·5 mm. long. Coronæ phylla ext. 1·5 mm., phylla int. 1 mm. long. Gynostegium 1·5 mm. long. Antherarum appendices erectæ, ovatæ, 1·5 mm. long. Pollinia oblongo-pyriformia, ·2 mm. long., glandulæ aliquanto breviori affixa. Styli pars exserta circa 1·25 mm long.

This chiefly differs from *A. Manni* N. E. Br. in the more prominent outer coronal leaves of the flowers, the shorter, broad, entire leaves of the inner corona, and the exserted style.

ARISTOLOCHIACEÆ.

Aristolochia ceropegioides, sp. nov. Planta volubilis, glabra; *caule* aliquanto compresso distanter folioso paucicostato; foliis petiolatis ovatis vel ovato-oblongis acuminatis apice ipso obtusis basi sæpe obliquis truncato-rotundatisque trinervibus membranaceis; *floribus* pro rata parvis pedicellatis in racemos breves paucifloros bracteatos minute puberulos ordinatis; *bracteis* linearibus oppositifloris; *pedicellis* ovario subæquilongis; *perianthii* in sicco nigri utriculo ambitu subcirculari quam tubus infundibularis plane breviore lobis 3 inter sese subsimilibus inferne triangularibus superne in caudam aliquanto tortam sat brevem excurrentibus; *columna genitali* breviter stipitata 6-loba; *antherarum* loculis oblongis obtusissimis; *stigmatibus* antheras bene superantibus inter se similibus oblongis marginibus stigmatosis confluentibus; *ovario* cylindrico minute puberulo.

Yaunde, Bitye; *Bates*, 1235.

Folia (limbus) 8–10 × 4–5 cm., in sicco grisea, subtus pallidiora; costæ costulæque necnon reticulum laxum pag. inf. bene aspectabiles; petioli 15–20 mm. long., basi torti. Racemi (axis) 1·5 cm. long. Pedicelli 5 mm., ovarium 7 mm. long. Perianthii utriculus 9 mm. long., inferne 4 superne 6 mm. lat.; tubus 18 mm. long., basi 2 mm., medio 3 mm., ore 7 mm. lat.; lobi 15–17 mm. long., basi 4 mm. lat., cito usque 1 mm. contracti. Columnæ genitalis stipes 1 mm. long.; antherarum loculi totidem; stigmata ultra antheras fere 2 mm. eminentes, superne libera.

Known among hexandrous African species by the 3-lobed limb. When dried the flowers look somewhat like those of a *Ceropegia* with free corolla lobes.

Aristolochia Ju-ju, sp. nov. Planta volubilis, *caule* valido cortice cinereo prominenter rugoso lenticelliferoque obducto jam efoliato florum racemos perbreves emittente; *foliis* ——; *pedicellis* sat elongatis minute puberulis; *perianthio* majusculo utriculo oblique inflato ovoideo intus minute pubescente quam tubus elongatus subcylindricus incurvus intus pilis crassiusculis hac atque illac præditus multo breviore lobis 3 abbreviatis inter se æqualibus triangularibus apice breviter acuminatis interjectis lobulis 3 multo minoribus; *columna genitali* breviter stipitata 10-loba; *antherarum* loculis anguste oblongis obtusis; *stigmatibus* ex antheris eminentibus oblongis apice liberis marginibus stigmatosis confluentibus; *ovario* cylindrico pedicello subæquilongo.

South Nigeria, Degema Division; *Talbot*, 3766.

Caulis 10–14 mm. crass. Racemi (axis) vix 1 cm. long. Bracteæ lineari-oblongæ, circa 7–8 mm. long. Pedicellus cum ovario 4–5 cm. long., ille solus 1·5–2 cm. Perianthii utriculus 3 × 2–2·5 cm.; tubus usque 7 cm. long., inferne fere 1·5 cm., ore 2·5 cm. lat.; lobi 2 cm. long., ima basi totidem lat.; lobuli circa 5 mm. long. Columnæ genitalis stipes 1 mm., antheræ 3 mm. long. Stigmata ultra antheras 2 mm. protrusa.

So far as concerns its flowers, this should be placed close to *A. Mannii* Hook. f. and *A. triactina* Hook. f.; from the latter of these the perianth lobes serve at once to distinguish it. The perianth of *A. Mannii* has a smaller utriculus and very short lobes without

the intervening lobules; moreover, although Hooker described the tube as 2½ inches long., *i.e.*, about as long as that of *U. Ju-ju*, a measurement copied into the *Flora of Tropical Africa*, inspection of the type material at Kew shows this to be nearly double the true length.

As its name implies, this is one of the "Ju-ju" plants. Before leaving England for what unhappily proved her last visit to Africa, Mrs. Talbot promised to secure leaves if possible of this fine species, a promise frustrated by her death. The flowers seem so different from anything hitherto described that no apology is necessary for describing the species without leaves. The material consists of a piece of stem with a single inflorescence and a pencil drawing made from the living plant.

EUPHORBIACEÆ.

Drypetes peltophora, sp. nov. *Ramulis* bene foliosis primo microscopice puberulis mox glabris corticeque cinereo obductis; *foliis* breviter petiolatis oblongo-lanceolatis apicem versus sæpius coartatis obtusis raro acutis basi obtusis necnon aliquantulum obliquis margine undulatis vel undulato-denticulatis papyraceis utrobique glabris vel pag. inf. summum levissime puberulis; *floribus* subsessilibus in fasciculos breves perpaucifloros squamis minutis sericeis stipatos ex axillis ramulorum hornotinorum haud defoliatorum oriundis digestis; *sepalis* ♂ 4 orbicularibus extus et intus minute fulvo-sericeis margine ciliolatis; *staminibus* 8 filamentis complanatis glabris quam antheræ late ovoideæ utrinque obtusissimæ plane longioribus; *disco* latissimo plano margine 10–12-lobato fere omnino glabro; *floribus* ♀ deficientibus.

Yaunde, Bitye; *Bates*, 1295.

Folia usque 10 × 4 cm., sæpe vero minora, *e. g.* 7–9 × 2·5–3·5 cm.; costæ laterales utrinque 6–7, ut reticulum pag. inf. bene aspectabiles; petioli 5 mm. long. Stipulæ haud visæ. Pedicelli 1·5 mm. long. minute sericei. Flores explanati circa 9 mm. diam. Sepala 4 × 4 mm. Filamenta 2 mm., antheræ 1 mm. long. Discus medio levissime elevatus, ægre 3·5 mm. diam.

To be inserted in the genus next *D. Dinklagei* Hutchins., from which it is distinguished by the smaller, not quite entire leaves, and the larger ♂ flowers with longer filaments and a much broader flat disk.

Drypetes Taylorii, sp. nov. Verisimiliter frutex, glaber; *ramulis* subteretibus insigniter costatis cinereo-corticatis foliosis; foliis lanceolato-oblongis vel oblongo-obovatis basi obtusis margine leviter undulatis tenuiter coriaceis pallide nitidis costis lateralibus utrinque circiter 10 pluribus aliis ord. inf. interjectis omnibus una cum rete pag. utraque optime eminentibus; *stipulis* ——; *fasciculis* multi- vel plurifloris ex ramis jam foliis orbis vel fere orbis oriundis; *floribus* ♂ solummodo cognitis breviter pedicellatis; *sepalis* 6 subbiseriatis interioribus sæpe paullulum minoribus ovatis vel oblongis obtusis; *staminibus* circa 12 circum vel inter disci lobulos insertis filamentis quam antheræ plane longioribus; *disco* sat elevato latere rugoso superne plano medio rudimentum ♀ parvulum lineare vel brevissime umbonatum gerente.

East Africa, Mtoni; *Rev. W. E. Taylor.*

Folia 15–20 × 5–7 cm., in sicco brunnescentia; petioli 2–3·5 cm. long., basi necnon sub limbo incrassati. Pedicelli circa 3 mm. long. Sepala 2–3 mm., filamenta 2–3 mm., antheræ ovatæ 1 mm. long. Discus diametro 1 mm. paullo excedens.

The six sepals are somewhat aberrant from the genus, also the stamens placed sometimes between rugæ of the disk, a character, although shared by some species of the genus, pointing to *Lingelsheimia*, but the habit of that is different. The plant does not seem closely allied with any known species.

Drypetes Gossweileri, sp. nov. Arbor erecta trunco sat gracili prædita; *ramis* robustis aliquanto tortuosis cortice cinereo rimoso lenticellifero circumdatis; *ramulis* fusco-corticatis foliosis glabris; *foliis* petiolatis ovato-oblongis obtusis brevissimeve cuspidato-attenuatis basi late rotundatis papyraceis margine undulatis glabris supra nitidulis subtus opacis costis lateralibus utrinque 6–8 aperte arcuatis ut reticulum utrobique bene eminentibus; *fasciculis* pauci- vel plurifloris plerumque ramulis defoliatis insidentibus; *pedicellis* validis quam flores longioribus minute fulvo-velutinis; *sepalis* florum ♂ pro rata magnorum 5 oblongo-ovatis apice rotundatis pag. utraque præsertim vero dorso fulvo-velutinis; *staminibns* fere 40 inter disci lobulos sæpe insertis filamentis quam antheræ oblongæ obtusæ paullulum longioribus; *rudimento* ♀ subnullo.

Portuguese Congo, Mayumbe, rare in forests at Buco Zau; *Gossweiler*, 6867.

Truncus sec. cl. inventorem 30 m. alt. Folia pleraque 14–18 × 6–8 cm. (nonnunquam modo 10 × 5 cm.) petiolo 1–1·5 cm. long. exempto, supra in sicco brunnescentia. Stipulæ haud visæ. Pedicelli usque 3·5 cm. long., sed sæpe breviores, sub flore incrassati. Flores odorem pungentem ingratum spirantes. Sepala alba (dorso dilute viridia), 13 × 11 mm. Filamenta 5 mm., antheræ 4 mm. long. Discus 7 mm. diam. Flores ♀ ignoti.

Allied to *D. Staudtii* Hutchins., but somewhat different in the shape of the undulate (not serrate) leaves and with larger flowers on longer pedicels, velvety (not glabrous) sepals, and nearly 40 (instead of about 15) stamens.

PLANTAGO CYNOPS L. IN KENT.

By Henry N. Ridley, M.A., F.R.S.

Plantago Cynops L. is a low shrubby plant forming a good-sized tuft or cushion. The stems are woody and for about 6 inches bare of leaves. The leaves are narrow and semiterete, linear acute, and grooved above, of a grey-green, and like most of the plant hairy. From the axils spring hairy peduncles little longer than the leaves, bearing at the top globose heads of flowers. To each head is a pair of ovate rounded green cuspidate bracts tinted with purple; the sepals are short and enclose the corolla tube, which is rather long for a Plantain; the wide spreading lobes are lanceolate and acute, translucent and whitish. The whitish filaments are very long and hairy, and the anthers pale yellow; the slender and long persistent style, at first pale, becomes brown; the capsule is conic with oblong lanceolate smooth seeds. The plant is a native of the Mediterranean region, occurring in dry barren chalky spots in Southern France, Lot, Toulon, Villefranche, Gap, and Ain; also in Spain, Italy, Switzerland, Austria, Crete, and Greece. It was therefore rather surprising to see it growing and apparently certainly wild on chalk downs between Cobham and Meopham in Kent.

The plant was first found by Mr. Charles Baker, who resides in this district, in May last, who gave a specimen to Miss L. Florence Ridley, who sent it to me. I visited the locality on Sept. 8th with Mr. Baker and Miss Ridley and found the plant in flower.

The locality is a very dry barren bank of chalk with very little soil, covered, however, with dwarf forms of *Origanum vulgare*, both pink and white, only a few inches tall—*Carlina*, *Erigeron acre*, *Pastinaca*, and other chalk-hill plants, with scattered wild rose-bushes and stunted hawthorns; no grass was seen except a few poor patches of *Brachypodium pinnatum*. The ground appears never to have been cultivated or even ploughed; at the base of the valley below attempts have been made to cultivate, but without much success. Though there is a quantity of Mustard on the further hill, I could not see a single plant of anything which could have been introduced where the *Plantago* was growing.

There is one clump of the plant in an oval form about two feet across, the centre of which has died out and the edges are pushing out all round: the strong woody stems show that the clump is an old one; its general appearance is that of a cluster of seedling pines. For twelve yards from both sides of the clump smaller plants are scattered along, evidently seedlings, many with well-developed woody stems. There are no houses near the spot, the nearest being a farm-house, a considerable distance off, and separated from the hill-side by a narrow wood, so that it is extremely improbable that the plant could have been a garden introduction. Indeed, no one is in the least likely to cultivate so inconspicuous a shrublet; nor can I find that the plant has ever been in cultivation in England. It is clearly not introduced as a cornfield weed, as it is shrubby and does not grow in made ground; nor is there any rubbish from elsewhere thrown there or in the neighbourhood.

This region of Kent, however, is peculiar in having several very local plants which are hardly wild elsewhere in England, such as *Salvia pratensis*, *Althæa hirsuta*, and *Orchis hircina*, all of which grow within a few miles of this spot. It may be worth recording that owing to cultivation during the war *Althæa hirsuta* very nearly disappeared from its long-known locality here; but in a wood some miles away, which was much cut away during the war, Miss Ridley found a large quantity had sprung up; I knew the wood when I was a boy, frequently exploring it, but I cannot remember ever to have seen the *Althæa* there, though it was a plant I knew well.

The remarkable thing about the occurrence here of *Plantago Cynops* is that it appears to be quite absent from Northern France; nor has it, so far as I know, been seen on any other of our chalk downs, but most of these are more or less grassed over. It is seldom that one finds a down so very barren and unprovided with soil as this, which appears to be the kind of locality in which *P. Cynops* grows.

THE SEQUENCE OF FUNGI AND MYCETOZOA.

BY W. T. ELLIOTT, D.D.S., F.L.S., AND JESSIE S. ELLIOTT, D.Sc.

AN oak branch about 15 ft. in length and about 1¼ ft. in diameter that was blown down in a gale at Tanworth-in-Arden in the autumn of 1912 has been carefully kept under observation with the object of noting the sequence of fungi or mycetozoa which might grow upon it. It was in the first instance quite sound with the leaves attached and showed no trace of decay. In the autumn of 1913, after lying on the ground in a conifer plantation for twelve months, it was profusely covered with a dense growth of the black gelatinous cups of *Bulgaria polymorpha* which issued through the cracks in the bark. In the following autumn (1914) a further dense growth of this same fungus appeared, and at the same time on the sawn end of the branch were seen traces of the purple fruiting bodies of *Coryne sarcoides.* During the next autumn (1915) *Bulgaria polymorpha* again made its appearance, but less in quantity; and at the same time coming up through the same cracks in the bark was observed everywhere the fruiting structures of *Coryne sarcoides.* Again, in the autumn of 1916 *Coryne sarcoides* appeared in abundance and with it at the same time a still further diminished quantity of *Bulgaria polymorpha.* The latter has never been seen there again. During the winter (1916–17) a small patch of *Stereum hirsutum* appeared.

In the autumn of 1917 only a trace of *Coryne sarcoides* made its appearance, and since then has never been seen there: also, a small growth of *Stereum hirsutum* as well as a small patch of *Panus stypticus* came up, and the latter remained in evidence until the following March. In 1918, during the autumn, a cluster of the sporophores of *Hypholoma fascicularis* appeared on one of the ends of the log as well as the small patch of *Stereum hirsutum.*

In the autumn of 1919 after seven years of observation the first Mycetozoon appeared, an area of about four square feet being covered with a dense growth of *Physarum nutans* Pers., which appeared through those cracks in the bark which in previous years had been occupied by *Bulgaria polymorpha* and *Coryne sarcoides*: at the same time a large patch of *Physarum nutans* also developed on the sawn end of the log; the wood even then was so hard and dense that much difficulty arose in cutting any away. Subsequently, on the side opposite that on which the Mycetozoon developed *Phlebia merismoides* appeared, covering an area of about three square feet: also, clusters of *Hypholoma fascicularis* and *Hypholoma sublateritia* developed at opposite ends of the log.

In June 1920 one sporophore of *Pluteus cervinus* appeared, and during June, July, and August the Mycetozoon *Physarum nutans* sent up a continuous crop of its minute grey sporangia covering the same area it occupied in the autumn of 1919, and in addition the space which was then occupied by *Phlebia Merismoides.* In July (1920) a second species of Mycetozoon—*Stemonitis fusca* (Roth)—made its appearance; its white plasmodium emerged in two places about six inches apart through the bark on the central surface of the log; one of these developed sporangia, and the other formed a schlerotium which remained *in situ* for about ten days, and then disappeared apparently into the wood; we have observed that plasmodia will at times disappear in this manner.

The log at the present time (August 1920) is still hard, although showing some signs of decay, yet it has been lying in the same place in this conifer plantation for eight years. The entire disappearance of the two fungi, *Bulgaria polymorpha* and *Coryne sarcoides*, first referred to and the abundant growth of the Mycetozoon *Physarum nutans* in precisely the same place lead us to the conclusion that their mycelia were absorbed and destroyed during the plasmodial stage of the Mycetozoon, for it is well known that these organisms can thrive on mycelium: probably the plasmodium thrived on the mycelium for about three years before it proceeded to the stage of fructification.

SHORT NOTES.

Scilla campanulata Ait. (p. 22). I have known the area between Truro and Perranporth intimately for years and remember clearly a strong garden *Scilla* which grew like a weed in a garden near Perranzabuloe Church, and strayed from the garden into hedgebanks outside; it may be the same species. Another plant which strays out of bounds and bids fair to become a permanent element in our flora is *Cotoneaster Simonsii* Hort. A bush planted in Perranzabuloe churchyard some forty years ago has given rise to thriving bushes (bird-sown, no doubt) in several spots within half a mile. These were recorded by Mr. W. Tresidder some years ago, and recently I noticed thriving young plants in the neighbourhood of planted bushes at Silverwell in the next parish.—F. Rilstone.

Arum italicum Mill. in Sussex. At the latter end of May this year I had an opportunity of examining a fresh specimen of this species from West Sussex, a fine clump having been found near Arundel by Mrs. and Miss D. Powell. As far as I am aware, the only other station in the county is in the Broadwater neighbourhood (Arnold, Fl. Suss. 75, 1887). The flowering stem examined was about 18 inches tall with a spathe of 13 inches; the yellow spadix, measuring about 5 cm., was noticeably longer than its naked peduncle; the barren filaments were warty at the base; and the cluster of fertile ovaries were much longer in proportion to the ring of stamens than in *A. maculatum*. The leaves, which were not particularly white-veined, had the diverging and projecting lobes characteristic of Miller's species. The above features are those specially remarked upon by Boreau, Coste and Rouy, the first author noting that the leaves are only rarely veined with white in the area of his work (Fl. Cent. Fr. ed. 3, ii. 736, 1857). Townsend (Fl. Hants, 327, 1883) described the Isle of Wight plant as a new variety, *neglectum*, having leaves more frequently spotted, their apex more rounded, and the basal lobes less triangular and less spreading. The Arundel specimen did not agree with this description.—C. E. Salmon.

Ranunculus Lingua. In Camb. Brit. Fl. iii. 127 (1920) we read in reference to this species—"We have not noticed any glabrous form (*R. lingua* var. *glabratus* Wallroth, Sched. Crit. 288 (1822)) in this country, where the plants conform to *R. lingua* var. *hirsutus* Wallroth *loc. cit.*" Upon examining the examples in my herbarium I was interested to see this point borne out in all the specimens save one. This important exception, which agreed with Wallroth's diagnosis of his *glabratus*—"Caule, calycibus foliisque utrinque glaberrimis,"—was gathered by my friend A. J. Crosfield in 1919 in South Buckinghamshire; the locality lies in District IV of the botanical map accompanying Dr. Druce's account of the botany of the county in the Victoria History, 1905.—C. E. Salmon.

Echium plantagineum L. A single plant in full flower was found by me in a meadow near a farm at Boxgrove, about 3½ miles N.E. of Chichester, on August 20th last. It has, I believe, never before been recorded for Sussex. Mr. A. J. Wilmott has confirmed the identity of the plant.—F. Druce.

The Genus Calobryum. Professor Douglas Campbell in his paper "Studies in some East Indian Hepaticeæ: *Calobryum Blumei*, N. ab E." (Ann. Bot. cxxxiii. 1 (1920)) gives three species in this genus as known at present. He has, no doubt inadvertently, overlooked the fact that a fourth species is known from New Zealand, viz. *C. Gibbsiæ* Steph., first recorded by me in this Journal for 1911 (xlix. 265), and subsequently described by Stephani (Sp. Hep. vi. 76 (1917). Other new species recorded in my paper, and since described, are: *Aneura Gibbiana* Steph. (*op. cit.* p. 28) and *A. papulolimbata* Steph. (p. 36).—S. S. Gibbs.

REVIEWS.

Flora of Jamaica, containing Descriptions of the Flowering Plants known from the Island. By William Fawcett, B.Sc., &c., and Alfred Barton Rendle, D.Sc. &c. Vol. iv. Leguminosæ to Callitrichaceæ. 8vo, cloth, pp. xv, 369; 114 text illustrations. Trustees of British Museum, Longmans, &c. 1920. Price £1 5*s.*

This volume, the third in order of publication, was among the many books delayed by the War. In character it resembles its predecessors, which were noticed in this Journal for 1911 (p. 172) and 1915 (p. 116), hence there is no need to repeat what has been said as to details of arrangement. We may sum these up by saying that, by its numerous illustrations, its careful investigation of the earlier authors, and above all by its thorough examination of the material from old collectors preserved in the National Herbarium, the Flora, whether regarded from the standpoints of science or of general utility, is in advance of any previous work of its kind.

The arrangement being that of Engler and Prantl, the statement that the volume includes "Leguminosæ to Callitrichaceæ" will not convey much indication of its contents to those who follow other classifications. It comprises Euphorbiaceæ, Rutaceæ, Geraniaceæ, Polygalaceæ, and numerous other groups, and is moreover somewhat misleading, for all that appears about Callitrichaceæ is a short paragraph introductory to the Order on the last page, which, as the paging of the volumes is not continuous throughout the work, might, we think, have been deferred to the next instalment, to which it belongs.

The species now first described in English are not large, and have already been printed in Latin in this Journal in compliance with the rule which demands that diagnoses of new plants should be published in that language. There are several new combinations, some resulting from the long-delayed recognition of Philip Miller's work in the eighth edition of his *Gardener's Dictionary*, but these have never been wantonly made: *Sesbania Sesban* comes dangerously near the duplication which has been generally condemned.

The substitution of *Pithecellobium* for *Pithecolobium* (p. 146), which at first suggests a misprint, should, we think, have been explained. Mr. Fawcett kindly gives us the following note:

"*Pithecellobium* was founded in *Hortus Monacensis* (1829) 188, by Martius, who gives as its equivalent 'Affenohrring.' He assigns the name to certain species of *Inga* mentioned, namely *cyclocarpum* (*Ing.* W.), *inundatum*, and *Unguis-cati*. Willdenow founded his *Inga cyclocarpa* on *Mimosa cyclocarpa* (Jacq. Fragm. Bot. 30, t. 34, f. 1); the figure shows the pod as a complete ring. In *Flora*, Beiblätter, ii. 114 (1837), Martius spells the word *Pithecollobium*, and says of it: 'genus Ingas auctorum amplectens a me in Horto Reg. Monac. constitutum [1829, p. 188] Brasiliensibus dicitur *Brincos de Sahoy*, Affenohrring germanice, unde nomen graecum petitum . . . . Huc pertinent inter alias multas: *Inga excelsa* Kunth, *Unguis-cati* W., *bigemina* W., *cyclocarpa* W., *cochleata* W., *contorta* Grah.' 'Brincos' is Portuguese for 'earrings,' but 'Sahoy' is certainly not the usual word for 'monkey,' and is more probably the name of a place. Possibly the women of Sahoy wore the *cyclocarpa* pods round their ears."

The substitution of Loureyro for the usual spelling of the name is in accordance with his autograph MS. in the library of the Department of Botany; Necker's commemorative name *Lourea* was due to the misspelling of the younger Linnæus, who based his *Hedysarum vespertilionis*—the type of the genus—on a plant sent from Cochin-China by "Io de Lourei."

On p. xv is an important "Note on Dr. Patrick Browne's *Natural History of Jamaica*" which is in danger of being overlooked; it should, we think, have been referred to in the preface. It is as follows:—

"Dr. Patrick Browne published his *Natural History of Jamaica* in 1756, three years after the appearance of Linnæus's *Species Plantarum*. Browne did not adopt the binomial system of Linnæus, but quoted as synonyms of his own diagnostic names the diagnoses of the *Species Plantarum*. In his own copy of the *History*, now in the library of the Linnean Society, Linnæus added the binomial as a marginal note.

"Linnæus acquired Browne's herbarium in 1758, and has underlined in his copy of the *History* the first letter of those species of which there was a specimen in Browne's herbarium. In some instances these specimens were the foundation of species published by Linnæus in the *Systema*, edit. 10, 1759, for instance, *Cassia viminea*; other represented species which Browne had failed to identify were those in the *Species Plantarum*, for instance, *C. biflora.* Sometimes a specimen in Browne's herbarium has not been identified by Linnæus with any diagnosis of Browne, but has been published in the *Systema*, for instance, *C. pilosa.*"

We hope that, in the interests of West Indians and of botanists generally, this important addition to our colonial floras will proceed with all possible speed.

The Nature Study of Plants in Theory and Practice for the Hobby-Botanist. By THOMAS ALFRED DYMES, F.L.S. With an Introduction by Prof. F. E. WEISS, F.R.S. 8vo, pp. xviii, 173: 54 illustrations. Price 6*s*. net. S.P.C.K.

IT might be thought that there was not room for another introduction to botany based on British plants, and it must be owned that one or two recent pretentious works of the kind might have been dispensed with; but Mr. T. A. Dymes's little book on *The Nature Study of Plants* (S.P.C.K., 6*s*. net) deserves a welcome and will, we think, receive one, not only from "the hobby-botanist," for whom it is specially intended, but from the teacher, who will find in it much that is useful and suggestive.

The volume is divided into two parts: in the first ("Theory") we have a description, in their various bearings, of "the seven factors of life, animal and vegetable"—five (Respiration, Nutrition, Growth, Protection, and Rest) "which are concerned with the preservation of the individual," and two (Reproduction and "the care of the children") "which are concerned with the preservation of the race." The second part ("Practice") is devoted to a life-history of the Herb Robert (*Geranium Robertianum*): "it is easy," says Mr. Dymes, "to watch our friend from its babyhood to its grave," but we doubt whether anyone has undertaken the task before, and it could hardly have been fulfilled with greater completeness. For example, Mr. Dymes had been "struck by the fact that the Herb Robert in [his] borders, which are a well-stocked menagerie of small and voracious wild beasts," seemed hardly ever to be attacked by any of these; and this set him thinking about its means of protection, which he finds in the hairs and in the strong smell. A series of experiments with slugs, woodlice, and caterpillars, who were confined to a diet of the leaves, showed that in many cases these were not eaten at all, or the eaters came to a premature end—notably in the case of a large brown slug (*Limax maximus*), "who began eating during the second night, but by the next evening he had turned a fearful colour and was dead." "Mr. Dymes began to think that the Herb Robert had to all intents and purposes solved the problem of complete protection," but the grub of a weevil (*Cœliodes*) "habitually feeds upon it."

We regret that want of space prevents us from noticing the volume at greater length, but a word must be said in praise of the numerous original illustrations, and of the clear simple literary style in which it is written. The book, too, is of value as an example of what may be done with regard to our common British plants; there is a gratifying absence of theorizing, and an allusion—rare in present-day literature—to the reverence due to "the Scheme of Creation and its Creator."

BOOK-NOTES, NEWS, ETC.

On p. 62 we protested against what we ventured to call the perverted form of industry which finds its outlet in the creation of "new combinations" in nomenclature based solely upon literature; and we cited in support of our protest examples from the publications of Mr. Oliver Atkins Farwell. In his *Notes on the Michigan Flora*, ii., just to hand, Mr. Farwell pursues his unfortunate practice, which, as we before remarked, can only result in the addition of new and still-born names to our already over-burdened nomenclature. On p. 361 he writes: "*Phæocephalum* Ehrh. (*Triodon* Pers. and *Rhynchospora* Vahl) appears to be the oldest name for the genus"—a statement which is followed by the creation by seven "n. comb." It will be observed that he gives no reference to Ehrhart; the name (which, of course, finds no place in the Kew *Index*) appears in the Index to Ehrhart's *Phytophylacium* published in his *Beiträge*, iv. 146, where and on the label attached to the specimen it stands as "Phæocephalum: Schoenus fuscus Linn." As is well known, Ehrhart was accustomed to attach one-word names to the plants distributed in his exsiccata, but there is no reason for supposing that he had any intention of claiming for them generic rank, nor could any one familiar with the *Beiträge* ever entertain the notion: thus in the decas of which *Phæocephalum* is the first, appear:

"6. Polyglochin. Carex dioica Linn.
7. Psyllophora. Carex pulicaris Linn.
8. Leucoglochin. Carex Leucoglochin L."

Can it be supposed for a moment that Ehrhart intended to establish a genus on each of these species?

Canon John Vaughan has done well to bring together in a volume which takes its title from the first of them—*The Music of Wild Flowers* (Elkin Mathews, 8*s*. 6*d*. n.)—the essays, "contributed to various journals and magazines, which illustrate the interest and delight to be found in the pursuit of botany." The aspects dealt with are very various—most are associated with some locality with which the author has special acquaintance—Winchester, his present residence; the Suffolk shore; St. Aldhelm's Head, Suffolk; the New Forest and other parts of Hampshire: others deal with special groups—daffodils, fritillaries, climbing plants, the flora of our railways; or with the plants of various seasons—the woods in May, winter foliage, and early spring. The present writer is reminded by the Canon's graceful acknowledgement that the pleasant essay on Fuchs's *Herbal* was due to his fortunate suggestion. The essays are attractively written and well-informed: occasionally we think the information might be more definite—*e. g.* the author of the "old list of Hampshire plants made in the eighteenth century" and the place of its publication might have been mentioned: it is of interest to know that the white-flowered form of *Ophrys apifera* found by Dean Garnier—the author referred to (see Journ. Bot. 1873, 256)—was seen by Canon Vaughan in the same locality a hundred years later. The publisher must, one assumes, have some reason for issuing with uncut edges a book printed on soft paper, but it is difficult to conjecture what this can be.

THE *Kew Bulletin* (no. 7) contains an account of "A Trip to the Knysna," undertaken in connection with the work for the Botanical Survey of the Union of South Africa which was begun in 1918 by Mr. S. Schonland; a description of two new species of *Ovulariopsis* from the West Indies by Miss E. M. Wakefield; notes on *Jeffersonia* and *Plagirhegma* (the latter united with the former by Bentham and Hooker) by Mr. Hutchinson, and on *Amoora spectabilis* and *A. Wallichii* by H. H. Haines; a revision of the cultivated species of *Phellodendron*, by Mr. Sprague; and a continuation of the "Decades Kewenses," mostly by Mr. J. S. Gamble.

THE latest issue of *Notes from the Royal Botanic Garden, Edinburgh* (nos. 57, 58), contains descriptions of forty new species of *Rhododendron*, mainly from the apparently inexhaustible collections of this genus which were made in Yunnan and elsewhere by Mr. G. Forrest, whose name is associated with Prof. Balfour's in most of the descriptions. We note that the date on the wrapper is "March 1920"; that of the Stationery Office on the first page is "9/20": in view of the difficulties connected with dates which at one time and for a long period characterized the *Kew Bulletin* it seems desirable to call attention to a possible source of confusion.

THE *New Phytologist* (July and Oct., published Aug. 24) has a long paper on "Hybridism and Classification in the Genus *Rosa*" by Mr. J. R. Matthews, which should interest British botanists: the author "would at present strongly support any systematist who returned to the Linnean conception of the species [*R. canina*], denoting its various combinations by some purely symbolical method," and thinks that "if a single aggregate species were submitted to systematic crossing and fully worked out along the lines of Mendelian research, we should obtain results which would form a real contribution to our knowledge of this most difficult genus." Dr. Gates continues his observations on "Mutation and Evolution" and Mr. J. H. Priestley writes on "The Mechanism of Root Pressure."

THE first memoir of the Botanical Survey of South Africa (Pretoria, 2*s.* 6*d.*) is devoted to a Phanerogamic Flora of the divisions of Uitenhage and Port Elizabeth, by Dr. S. Schonland. It contains notes on the systematic elements of the Flora and on plant-formations and plant-associations, followed by a list of the plants known to occur in the districts, with localities and occasional notes: a table of the genera with an indication of the number of species in each brings the useful memoir to a close.

WE have received the 35th and 36th Annual Reports (1918–19, 1919–20), issued together, of the Watson Botanical Exchange Club, which contain as usual much interesting matter, wherefrom we hope later to print extracts. An excellent portrait of the late E. S. Marshall faces the title.

TO OUR SUBSCRIBERS.

It seems right that our subscribers should be made acquainted with the difficulties which at present attend the production of the Journal and seriously threaten its continuance. The cost of printing steadily increases and shows no prospect of diminution, and, in spite of help rendered by friends in various ways, the annual accounts show a serious deficit.

The issue for last year resulted in a loss of £32 18*s.* 3*d.*; this, however, was practically defrayed by a small balance remaining from the sum raised by the late E. S. Marshall in 1917, and by generous donations from Dr. Britton of New York and Mr. C. E. Salmon.

For the present year this position is far more serious. The account delivered at the end of June, by which time practically all subscriptions for the year had been paid, showed a balance in hand of 15*s.* 9*d.* with which to carry on the remaining six months. Allowing for receipts from sales of numbers, reprints, etc., it is estimated that at the end of the year there will be deficit of over a hundred pounds, and this although the cost of the two supplements and of plates has been defrayed by the authors, and help towards the production of other papers has been received. Sums amounting at present to £25 have been received or promised by those who have been made acquainted with the position of affairs, but it will be seen that much more will be needed in order to protect the Editor from serious loss.

This being so, the outlook in 1921 is even more highly unsatisfactory, and it is doubtful whether it will not be necessary to terminate the existence of the Journal with the December number. The possibility of this has resulted in numerous expressions of hope that what is regarded by many in the light of a catastrophe may be averted: we need not say how deeply we ourselves should regret such a contingency, and have indeed already received promises of help to carry on, and suggestions whereby the Journal may be placed on a more secure footing. Among these the raising of the subscription to 22*s.* 6*d.* post free and the price of numbers to two shillings is the most practical; but it may be doubted whether this would be sufficient to put the Journal on a substantial footing. And nothing can be more unsatisfactory than that it should depend for support upon the result of continual special appeals, just as nothing can be more unpleasant than to be compelled to make them. Meanwhile we shall be glad to hear from any subscribers how the above proposal is regarded by them, and grateful for help towards this year's deficit; this will be duly acknowledged in our December issue, when the course determined on for the future will be announced.

The Editor.

"JOURNAL OF BOTANY" REPRINTS.

In view of the fact that the stock of these is in some cases practically exhausted, the attention of our readers is directed to the list which appears on the following page. Old subscribers of course already possess the matter contained in them in the pages of the *Journal*; but some of them appeared several years ago, and recent subscribers will thus not possess them. Some, which do not appear in the list, are already out of print; of others very few copies remain, and it will of course be impossible to reprint them: among the latter may be mentioned Mr. Dallman's *Notes on the Flora of Denbighshire* (1911), and Mr. Bennett's *Supplement to 'Topographical Botany.'* Of the Supplements to the *Biographical Index* no complete sets remain. It had been hoped before this to issue the second edition of the work, in which these Supplements are of course incorporated, but the present cost of paper and labour has rendered this impossible. Of the *Index* itself no copies remain, these having been lost in the course of transferring the stock to Messrs. Adlard. Mr. Garry's *Notes on the Drawings of Sowerby's 'English Botany,'* containing, as it does, much topographical information and numerous unpublished notes by Smith, Sowerby and others, should be in the possession of all interested in the history of British Botany: only sixteen copies remain.

It may be pointed out that, although for the most part relating to British Botany, certain of the reprints have a more general appeal. Such are the *Index Abecedarius*—a list of the plants in the first edition of Linnæus's *Species Plantarum*, showing at a glance what are included in that work, which has no index of species; the *History of Aiton's 'Hortus Kewensis,'* which contains much information as to the authors and contents of that classical work; the *Flora of Gibraltar*, which, besides a complete list, contains notes on the more interesting species; Linnæus's *Flora Anglica*—the first English Flora—has a bearing upon nomenclature: of all these there are numerous copies.

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No. 696 DECEMBER, 1920 Vol. LVIII

THE
JOURNAL OF BOTANY
BRITISH AND FOREIGN

EDITED BY

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NOTES ON BRITISH HAWKWEEDS.

By H. W. Pugsley, B.A., F.L.S.

The following notes have been compiled during an attempt to work out the hawkweeds (about 250 gatherings falling under some 70 species) that I have collected in various parts of Great Britain during the last 25 years. The genus, affecting principally, as it does, the rocks of hilly and mountainous districts and embracing many conspicuous and handsome forms, readily claims the attention of the botanist with a taste for climbing, and its complexity is sufficient to satisfy the systematist's most voracious appetite for new species and varieties.

The first account of the British Hieracia, the monograph of James Backhouse, Jun., published in 1856, gives satisfactory descriptions of 33 species, correlating them, as far as possible, with known continental forms. Backhouse's interest, however, was largely centred in the *Alpina* section, and his explorations were mainly confined to Teesdale and the Braemar and Clova Districts of Scotland. In more recent years Mr. Hanbury, the brothers Linton, and the late E. S. Marshall collected in many other Highland localities while Augustin Ley did similar work in Wales, with the result that many new forms were discovered and described. Mr. Hanbury made notable additions to the *Oreadea*, and both he and the Lintons greatly extended the lists of *Subvulgata* and *Cæsia*. Finally, Augustin Ley elaborated the *Eu-vulgata*, introducing a number of new forms identified with Scandinavian plants.

A complete account of the genus appeared in 1902 in Mr. F. N. Williams's *Prodromus*, in which some important characters, hitherto overlooked, were brought to notice; and in 1905 W. R. Linton's *British Hieracia* was published, with descriptions of 124 species and 131 varieties. This last-named book is by far the most useful to the student, but a larger work, with a full and accurate clavis accounting for every species, is still a desideratum; and in this connection the comparatively early deaths of W. R. Linton and Augustin Ley are much to be regretted.

Sub-genus Pilosella, Sect. Collinia.

Hieracium pratense Tausch.—I collected this plant in 1916 at Aviemore—apparently a new vice-county record for Easterness. It was growing with other hawkweeds on broken ground near the railway, where its status is uncertain. Nägeli and Peter, in their *Hieracien Mittel-Europas* (*Piloselloiden*), and Gremli, in his Swiss flora, adopt for this species the earlier name *H. collinum* Gochnat, Tent. Cichor. p. 17 (1808).

Sub-genus Archieracium, Sect. Amplexicaulia.

H. pulmonarioides Villars, Fl. Delph. iii. 133 (1789).

Exsicc. F. Schultz, Herb. Norm. 707; Billot (continué) 3640.

On July 31st, 1907, I collected this species on an old wall near Kenmore, in Perthshire. In this situation it had presumably been introduced, but its occurrence seems worthy of mention, as it does not seem to have been previously recorded as a naturalised plant in Britain, and it might perhaps be overlooked through confusion with the somewhat similar *H. amplexicaule* L.

The salient features of *H. pulmonarioides* may be stated thus:—Plant phyllopodous, with oblong or oblanceolate radical leaves, 5–20 cm. long, with ascending, cusped teeth (especially towards the base), and decurrent on the long, shaggy petioles; outer leaves obtuse, mucronate, inner acute or shortly acuminate, all clothed on both surfaces with soft, pilose hairs, interspersed, especially above, with fine glandular hairs. Stem 20–40 cm. high, corymbosely branched, sub-12 headed, pilose below, but becoming thickly glandular above with fine, dark, glandular hairs; cauline leaves 3–5, the lower lanceolate, broad-based or subamplexicaul, and toothed below, the upper ovate, acuminate, entire, sessile, becoming bract-like, all clothed like the radical leaves. Acladium and branches densely clothed with stellate hairs and long, fine, dark, glandular hairs. Involucre also densely clothed with similar glandular hairs. Ligules pilose-tipped. Styles livid.

H. pulmonarioides differs from *H. amplexicaule* in its clear green, non-viscid foliage, with a large proportion of the hairs not glanduliferous; in its narrower, less amplexicaul cauline leaves, and in the characteristic long, dark, glandular hairs of the inflorescence. Its heads are usually larger than those of *H. amplexicaule*, than which it is a more conspicuous and beautiful plant.

I have seen *H. pulmonarioides* growing in company with *H. amplexicaule* and *H. lanatum* Vill. on the dry rocks below the oratories at Saas-Fee, in the Swiss Valais.

Sect. Cerinthoidea.

H. anglicum Fr.—Although six varieties of this species are described in W. R. Linton's *British Hieracia*, it is probable that other equally separable forms of this polymorphic plant still remain to be distinguished. The Perthshire hills produce dwarf forms quite unlike the handsome, large-headed Teesdale plant, with a single cauline leaf, that apparently represents Fries's type. Some of these Scotch specimens are monocephalous and recall the sub-section *Alpina genuina*, while others bear 2 or more heads, with 2–3 reduced cauline leaves. Another Perthshire form simulates *H. cæsiomurorum* Lindeb. in its long-petioled, sharply-toothed leaves, while in parts of Westerness the prevailing form has mostly truncate-based foliage. The leaf-clothing of this species is also most variable, independently of the conditions of environment, for while the foliage is commonly pilose, in some forms it is almost glabrous and in others markedly flocculose.

Sect. Oreadea.

H. proximum F. J. Hanb.—A stylose-flowered form which I collected near Keswick in 1903 seems essentially identical with this plant, as represented in Messrs. Linton's set, differing only by its glaucous foliage. Mr. Linton concurs in the name. This is a new locality for *H. proximum*, which I think has hitherto been recorded only for N. Scotland and N. and E. Ireland. The prevalence of stylose-flowered hawkweeds in the Lake District is peculiar, for this condition of *H. anglicum* var. *jaculifolium* and of *H. duriceps* var. *cravoniense* also grows in the neighbourhood of Keswick. It may be noted that in habit and foliage *H. proximum* somewhat resembles *H. iricum.*

Sect. VULGATA, Sub-sect. SILVATICA.

H. SYLVATICUM Gouan.—The varieties placed under this species in *British Hieracia* show great diversity of form, and it is difficult, judging by the average standard of *Hieracium* species, to regard such a form as the small-headed variety *micracladium* Dahlst. as conspecific with W. R. Linton's varieties *tricolor* and *subcyaneum.* Dahlstedt's variety appears to have some affinity with his *H. variicolor.*

Sect. VULGATA, Sub-sect. SUB-VULGATA.

H. RUBIGINOSUM F. J. Hanb.—There occurs in Wharfedale, growing at intervals along the stream from Bolton Woods at least as far as Grassington, a well-marked form of this species that has been referred to the specific type, but which, as Mr. Linton suggests, approaches the Derbyshire variety *peccense* W. R. Lint. Its radical leaves are few and coarsely hairy on both sides, with rather small teeth; and the lowest of the 2–4 cauline leaves are narrowed below to short broadly-winged petioles. The stem is pilose throughout, and is clothed above, like the peduncles, as in var. *peccense.* The subacuminate phyllaries, however, differ from those of that variety in that the simple dusky hairs predominate, the glandular ones being but few. The plant is probably similar to that mentioned in *British Hieracia* (p. 40) as growing at Llyn Dulyn.

Of Backhouse's *H. vulgatum* var. *rubescens*, on which *H. rubiginosum* was founded by Mr. Hanbury, there is only one poor specimen from Backhouse in Herb. Mus. Brit., but two good Giggleswick examples exist at Kew. This form, which I failed to find last year at Giggleswick and Gordale, differs considerably from the Wharfedale plant and var. *peccense*, for it shows a more developed radical rosette and fewer cauline leaves, and the stem and leaves are less pilose. Its phyllaries, also, appear broad and obtuse, although described as "subacuminate" by Backhouse and in Babington's *Manual*, ed. 9.

This typical *H. rubiginosum* bears a resemblance to *H. sagittatum* var. *maculigerum* W. R. Lint., which Ley separated as a new species, *H. Lintoni* (Journ. Bot. xlvii. p. 16 (1909)), but it is distinguishable by its larger heads, with broader and less glandular phyllaries.

Like *H. holophyllum* W. R. Lint., *H. rubiginosum* (especially var. *peccense* and kindred forms) recalls the sub-section *Eu-Vulgata* by its cauligerous rather than scapigerous habit.

H. HOLOPHYLLUM W. R. Lint.—It seems possible that this species is identical with Backhouse's *H. vulgatum* var. *cinereum* (Mon. p. 61), but no specimens from Backhouse to confirm this can be traced in Herb. Mus. Brit. or at Kew. The description, except perhaps for the glaucous foliage, points to *H. holophyllum*, and it is not easy to see what other form growing on the Great Orme's Head can have been intended.

In 1902 I collected at Cheddar an example of the hawkweed gathered there three years later by Augustin Ley and referred to *H. rubiginosum.* This identification appeared to me doubtful, and as the British Museum possesses two specimens only of the plant, I have obtained further material for examination through the kindness of Mr. J. W. White, and am confirmed in the opinion that the name *H. rubiginosum* cannot stand for this plant. Mr. Linton also doubts the correctness of the identification.

The Cheddar form differs from *H. rubiginosum* (1) by its stem being normally slender, reddish, slightly pilose below and flocculose above, instead of robust, purple-tinted, pilose throughout and with black-based and glandular hairs above; (2) by its radical leaves being oval, more or less rounded at both ends (the outer ones occasionally retuse), apiculate, subentire or distantly denticulate, coriaceous, subglabrous above and sparingly pilose and reddish beneath, while those of *H. rubiginosum* are more ovate, acute, irregularly toothed, and pilose on both surfaces; (3) by its peduncles being densely flocculose, with a very few scattered simple and fine, glandular hairs, instead of less flocculose, with numerous dark, glandular and simple black-based hairs; and (4) by its smaller heads, with the phyllaries narrow and linear, but obtuse, grey-green and abundantly floccose, instead of broad, linear-lanceolate, obtuse or subacuminate, and dark olive-green, only slightly floccose.

These features bring the Cheddar plant towards *H. holophyllum*, and indeed in habit and foliage it is identical with specimens of the latter collected on the Great Orme. Moreover, some of the Cheddar specimens examined are shade-forms, producing thinner leaves, hairy on both surfaces, precisely like shade-forms of *H. holophyllum* from Wharfedale. In panicle, however, the Cheddar plant seems distinct, having rather more numerous heads on longer peduncles, each of which bears one or more narrow, linear, ciliate bracts. The involucres, too, are less broad and truncate, with distinctly narrower though obtuse phyllaries showing more abundant pilose and glandular hairs. It is therefore proposed to associate this hawkweed of the Cheddar cliffs with *H. holophyllum* of the limestone districts of Derbyshire, Yorks, and Carnarvon.

H. HOLOPHYLLUM W. R. Linton, in Journ. Bot. xxviii. 376 (1890); Brit. Hier. 49 (1905); Babington *Manual*, ed. ix. 256 (1904).

β. ANGUSTISQUAMUM var. nov.

Exsicc. E. S. Marshall, 3090.

Typo *H. holophylli* similis, sed folia exteriora nonnunquam apice retusa et ramificatio magis paniculata, sub-10-cephala, pedunculis paulo longioribus floccosis pilis tenellis interdum glanduliferis rarissimis et bracteis angustis linearibus ciliatis obtectis prædita. Periclinium haud latum, vix truncatum; squamæ angustæ lineares obtusæ, exteriores laxæ, omnes dense griseo-floccosæ, apice parce senescentes, pilis numerosis longis fuscis basi nigricantibus et brevioribus glanduliferis vestitæ. Styli lutei vel fuscescentes.

H. SAGITTATUM Lindeb. var. PHILANTHRAX Dahlst.—Upper Teesdale, Durham, 1903.

Sect. VULGATA, Sub-sect. CÆSIA.

H. CÆSIUM Fr.—A plant collected near Winch Bridge and High Force, Teesdale, in 1896 and 1903, appears to me to resemble *H. lasiophyllum* var. *planifolium* F. J. Hanb., but Mr. Linton does not assent to this name, although recognizing that the heads look like those of *H. lasiophyllum*. Its position must be held doubtful for the present, but it may be pointed out that it substantially coincides with Backhouse's description (Mon. p. 56) of *H. cæsium*. It is believed to be a widely-spread form in Teesdale.

An entirely different plant, with coarsely dentate leaves, similar to well-authenticated Swedish examples of *H. cæsium* Fr., was also found on the Durham side of Upper Teesdale in 1903,

H. FARRENSE F. J. Hanb.—Specimens agreeing with this Highland hawkweed were found in 1919 in Hesleden Glen, West Yorks. Mr. Linton assents to the naming.

Sect. VULGATA, Sub-sect. EU-VULGATA.

H. PINNATIFIDUM Lonnr.—A very slender form, seemingly referable here, with few-flowered panicle and long acladium, occurred sparingly by the Lawers Burn, Loch Tay, in 1907.

H. SCANICUM Dahlst.—The plant sent to the Watson Exchange Club by Mr. Waddell in 1902 from Saintfield, Co. Down, as *H. sciaphilum*, and determined as *H. diaphanoides*, is identical with *H. scanicum*, which at that date had not been introduced to the British Flora. It is stated by Ley (Journ. Bot. xlv. 111 (1907)) to be widely distributed in Wales and the west of England, so that its occurrence in Ireland is not remarkable.

The sub-umbellate panicle seems to be a marked character of this plant.

Sect. FOLIOSA.

H. BOREALE Fr.—A number of puzzling forms of this species were growing in company near Bethesda, Carnarvonshire, in 1902. All of them have blackish phyllaries, but while in some the heads are of moderate size, with livid styles, in others the heads are very large and showy, with bright yellow styles. In some the foliage approaches that of Scotch *H. corymbosum*, except for the hair-clothing, and in others the leaves are all narrow and subsimilar as in *H. rigens* Jord. The panicle in nearly every specimen is racemose-corymbose, with rather short, suberect branches.

The form of *H. boreale* occurring round London appears to be usually the variety *Hervieri* Arvet-Touvet, which may be known not only by its pilose peduncles and grey-green, pilose heads, but by its frequently more laxly-branched panicle.

THE PROBLEM OF THE BRITISH MARSH ORCHIDS.

By Colonel M. J. Godfery, F.L.S.

(See Journ. Bot. 1919, 137.)

Last May, near Vence, Alpes Maritimes, France, I found *Orchis latifolia* growing in quantity; as no other marsh orchid was present, and *O. maculata* was entirely absent, it was absolutely pure, and free from the complications brought about by hybridization.

I expected to find a fair proportion of plants with unspotted leaves, and also a wide variation in the markings of the lip. Both these anticipations proved erroneous. I searched repeatedly and carefully for specimens with unspotted leaves, but though I examined hundreds of plants, I only found two without spots. The markings on the lip were remarkably uniform, resembling those of our ring-spotted marsh orchid and *maculata*, but they did not vary to the same extent as in the latter species.

Below are given brief characteristics of a number of specimens:—

1. Average specimen. Height ± 35 cm., spike $6\frac{1}{2}$ cm., leaves oblong-lanceolate, ± 14 × 3 cm., densely marked with dark transverse oval spots; flowers red-lilac, mid-lobe of lip small, triangular, markings dark red-purple; spur conico-cylindrical, coloured, laterally compressed.
2. Spike longer and laxer, mid-lobe slightly longer, sepals faintly spotted, leaf-spots very faint.
3. Leaves faintly but plentifully spotted with small circular spots.
4. Abundantly spotted with small ringed spots; flowers pale, rather large, lip whitish, with dark purple markings all over it, mid-lobe very short, tooth like.
5. Leaves with very many small faint spots, the larger ones ringed; spike slender, lax; mid-lobe long (± 4 mm.) narrow.
6. Leaves densely spotted with small dark spots, lanceolate, rather acute; flowers pale lilac, with red-purple markings.
7. Similar, but leaf-spots large, dark, transversely oval, a few ringed.
8. Leaves very faintly spotted; flowers pale lilac, sepals faintly spotted; sides of lip considerably reflexed; lower bracts equal to flowers; spur rather slender.
9. Densely spotted, spots dark; bracts not exceeding flowers; flowers darker lilac.
10. Leaf-spots few, distant, faint; flowers large, dark red-violet; lip transversely oval, very bright coloured, area within markings whitish.
11. Abundantly spotted with very small spots; spike dense; bracts slightly exceeding flowers; flowers smaller, dark but very bright red-violet; lip not so broad, markings hardly darker than lip; spur dark coloured.
12. Leaf-spots faint, slightly ringed; bracts exceeding flowers; flowers pale lilac, markings faint; enclosed area whitish.
13. Leaves short, broad, ovate-lanceolate, spots many, oblong, dark, not ringed; spike dense, conical; flowers large, pale lilac, lip flatter, mid-lobe short, broadly triangular.

14. Leaves heavily spotted with ringed spots; flowers large, dark red-violet.

15. Very robust, 44 cm. tall, spike 13 cm., very leafy, leaves erect, slightly spreading; probably the var. *foliosa* of Continental authors, but only due, I think, to exceptionally favourable conditions; it has nothing to do with the Madeiran *O. foliosa*. Leaves 20–23 cm. long, 3½ to 5½ cm. broad, firm, flat at tip, with sparse minute spots on apical half only. Bracts (5½ cm. × 9 mm.) much exceeding flowers, spike comose. Flowers red-purple, throat wide whitish, sepals unspotted, lip broader than long (13 × 11 mm.), spur conical. This plant grew on the side of an irrigation canal where water trickled down.

The following bore a considerable resemblance to *O. prætermissa* Druce:—

16. Flowers pale lilac, lip flat, entirely covered with markings and dots; leaves with small sparse spots on apical half only.

17. Flowers delicate mauve, lip flat, covered with rows of tiny dots radiating in a fan, very like those of *prætermissa*; leaves unspotted, except for a few tiny spots at the tip of one leaf.

18. Flowers large, pale mauve; spur nearly white, short, conical, almost saccate, but in upper flowers more cylindrical and half as long as ovary. Leaves unspotted.

19. Flowers darker, red-lilac, leaves unspotted.

To sum up:—The leaves varied from elliptical-oblong (23 × 5½ cm.), to broadly ovate-lanceolate (10 × 3·8 cm.), with the majority of intermediate dimensions (12–15 cm. long by 2½ to 3 cm. broad), oblong-lanceolate to lanceolate. The spots varied (1) in amount, from dense to very sparse, sometimes covering the whole leaf, sometimes entirely confined to the apical half, sometimes restricted to a very few isolated spots near the tip; (2) in shape and size, *e.g.* large elliptical transverse spots, usually solid, not infrequently ringed, small circular spots, and minute almost imperceptible spots; (3) in depth of colour, sometimes dark and conspicuous, often faint, occasionally almost reaching vanishing point; but the leaves were practically always spotted. The flowers varied in colour from mauve or pale lilac to dark purple-red, with many intermediate shades. Two or three plants at Thorene had pink flowers. Sometimes the central area of the lip within the markings is much paler, or even nearly white. The pattern of the markings varied very little except in depth of colour, in fact it was remarkably uniform, consisting of two parallel longitudinal loops, one on each side of the lip, formed of continuous lines, often with a smaller more or less imperfect loop within the larger ones, and not infrequently supplemented by small or irregular spots outside the area enclosed by the loops. The lip is at first nearly flat, later the sides slope gradually downwards, and sometimes become decidedly reflexed, but occasionally fully opened spikes can be found in which even in the lowest flowers the sides only slope quite gently downwards. The mid-lobe is small, triangular and often tooth-like, hardly longer than the side-lobes; in one spike it was tongue-shaped and 4 mm. long, but this was due to the incision between it and the side-lobes being deeper. The sepals are usually, but by no means always, unspotted. The spur varies from conical to conico-cylindrical, ± 10 mm. long, compressed laterally, pale violet outside, white inside, densely covered within by rather long white papillæ. In one or two plants the spur was dorsally compressed, and in one it was very short and almost saccate, but in the upper flowers it was longer and nearly normal.

In the valley of Thorenc, 3600 ft. above sea-level, in June, *O. latifolia* L. was very abundant in the damper meadows, with no other marsh orchid present, though *morio*, *coriophora*, and *Gymnadenia conopea* were plentiful, the first-named already out of flower. *O. maculata* was abundant, but was mostly confined to the pine woods. The hybrid *latifolia* × *maculata* occurred, but was not very frequent. *O. latifolia* was in the main unaffected by hybridization, and was very uniform. Mdlle. A. Camus (Riviera Scientifique, 1918) recorded the varieties *ampla* A. & G. and *pinguis* A. & G. as occurring, but I found the descriptions of Ascherson & Graebner insufficient to enable me to distinguish them satisfactorily from the type. Single plants were observed here and there amongst the type in which the spike was so long as to occupy most of the stem above the leaves, but this appeared to be only an individual variation. I found one specimen of *latifolia* with apparently white flowers, but on placing it beside a pure white *maculata* it was seen to be very faintly tinged with extremely pale mauve. The leaves were light yellow-green, but were nevertheless faintly spotted, showing how inherent and persistent is the tendency to spotted leaves, even in an almost albino specimen. On June 18th I found an extraordinary plant. The two lowest flowers had very long slender ovaries; from the 11 bracts next above these arose, instead of an ovary and flower, a bracteated spikelet 6–7 cm. long, bearing 4 or 5 small flowers with very short ovaries; some had no spur, some a very short one, in some it was of normal length in proportion to the size of the flowers; two flowers had no column.

The net result of my observations was that I became convinced that the *O. latifolia* of these southern regions is identical with the spotted-leaved marsh orchid of Great Britain: I do not think they could be satisfactorily distinguished even as varieties. It is certainly not the case here that *latifolia* is a hybrid between an unspotted marsh orchid and *O. maculata*, for no marsh orchid with unspotted leaves exists in the neighbourhood, and at Vence *maculata* also was entirely absent. Barla's figures (Icon. Orch. pl. 48) represent *O. latifolia*, not × *O. Braunii*. The latter is a cross between spotted-leaved *latifolia* and spotted-leaved *maculata*, and not between an unspotted marsh orchid and *O. maculata*. I saw no specimens resembling Barla's varieties of *O. latifolia* on plate 49, with leaves spotted on both sides.

Mdlle. A. Camus, joint author with her father and M. Bergon of the Mon. des Orch. de l'Europe, wrote to me on Oct. 19th, 1919:—"In the environs of Paris, where this species is rather widely distributed, often without admixture, I have always seen *O. latifolia* with spotted leaves, more or less clearly marked, according to the individual, and perhaps according to the amount of light."

The difficulties in connection with the British marsh orchids have mainly arisen from the following causes:—

(1) The suggestion that *O. prætermissa* Druce is the true *O. latifolia* L., a proposition for which no definite proof is forthcoming, and which is in opposition to Continental experience and opinion.

(2) The supposition that the spotted-leaved British marsh orchid is a hybrid between *prætermissa* and *maculata*, whereas it appears to be simply *O. latifolia* L.

(3) The confusion which has arisen through the erroneous identification of the hybrids *prætermissa* × *maculata* and *incarnata* × *maculata* as *O. latifolia* L. In view of the facts that *prætermissa* and *incarnata* are both closely allied to *latifolia*, and that the leaf-spotting and also the lip-markings of *maculata* are very similar to those of *latifolia*, it will be seen that hybrids of either *prætermissa* or *incarnata*, into which the above two characteristics of *maculata* have been introduced by the part parentage of the latter species, are bound to bear a superficial resemblance to *latifolia*. But to assume that *O. latifolia* L. is therefore *prætermissa* × *maculata* is to base a wide generalisation on observations limited to a restricted and insular flora, and is a conclusion absolutely at variance with the fact that *latifolia* is a very widely distributed European species which grows in immense numbers where both the supposed parents are non-existent.

It is not only in England that the marsh orchids present difficulties. Dr. Keller wrote on March 15th, 1920: "The more one studies the group *latifolia-Traunsteineri*, the more perplexed one becomes. I believe, however, whilst reserving final judgment, that true *latifolia* always has spotted leaves, and that the forms with narrow leaves without spots are to be classed under the extremely polymorphic species *angustifolia* or *Traunsteineri*. I possess forms from Lychen (Germany), the water-colour drawing of which is almost identical with yours representing *prætermissa*, but these forms from Lychen were sent to me as *Traunsteineri*." As I do not know the latter species, I cannot express any opinion on Dr. Keller's suggestion, but it appears always to have narrow leaves, which is not at all the case with *prætermissa*. I found two or three plants of the latter with quite narrow leaves at Punfield, near Swanage, though the broader-leaved type was more numerous. Dr. Keller, Aarau, Switzerland, is anxious to receive specimens of *prætermissa*, dispatched *immediately after gathering*, for comparison with Continental forms. Nos. 16–19 above would, I think, if found in England, have been classed with *prætermissa* rather than with *latifolia*, though not typical enough to be definitely assigned to it. They were exceptional specimens—no more were found like them—and were undoubtedly only individual variations of *latifolia* in the direction of *prætermissa*. This expression, however, though convenient, is misleading. Probably species A does not vary in the direction of species B, but only in the direction of their common ancestor, C. There is always the possibility that some character of C, which has always been transmitted to B, but has long been eliminated from, or become latent in A, may exceptionally re-appear in the latter, either through partial reversion, or by accidental persistence in some particular strain of A, thereby apparently presenting a puzzling variation in the direction of B.

In June 1919 I saw five specimens of supposed *latifolia* from a reputed Irish station sent to Mr. St. Quintin by Mr. Carruthers, secretary of the Botanical Section of the Belfast Naturalists' Field Club for nearly thirty years. They were certainly not *latifolia*, nor were they pure *maculata*, though two of them nearly approached the latter, but were, in my opinion, *incarnata* × *maculata*. Later Mr. Carruthers wrote: "I examined some reputed stations (for *latifolia*) near Belfast, and find that *O. maculata* is always mixed up with *O. incarnata* and flowering at the same time, so you are quite correct in saying our plant is a hybrid, it can be nothing else."

Mr. S. A. Bennett, a keen botanist of the same club, also wrote to Mr. St. Quintin, sending (A) two plants identified as *prætermissa* by Dr. Druce, and (B) what he thinks is *prætermissa* × *maculata*. He stated that he had never found satisfactory *latifolia* in Co. Down or Co. Antrim, and that he regards all plants he has found with spotted leaves and streaked labels as *incarnata* × *maculata*. In the station where B grew, however, there was no *incarnata*, but plenty of *prætermissa*. Later he wrote:—"B is, I feel sure, *prætermissa* × *maculata*, the latter grows in great quantity amongst these spotted-leaved plants. The latter are in considerable numbers. . . . None of our plants so far as I know have ring-shaped spots. With regard to Col. Godfery's question 4 (J. B. 1919, 141) we can answer 'yes.' In the station from which A and B were sent we get *prætermissa* and *maculata* but no ring-spotted plant. Question 5. The answer is again 'yes.' Hybrids are present in quantity and they are not ring-spotted." This confirms my contention that ring-spotted plants are not produced by the crossing of unspotted marsh orchids with *maculata*. I attach little importance to the presence or absence of leaf-spots; nevertheless, since I have never seen ringed spots except in *latifolia* and its hybrids, they are sometimes useful as indicating the parentage of *latifolia*.

With the identification of our spotted-leaved marsh orchid as *O. latifolia* L., the problem of the British marsh orchids becomes considerably simplified, for there is no great difficulty in distinguishing *incarnata* from *prætermissa*. If we keep these three types clearly in mind, the only serious difficulty is the determination of hybrids. If these always held an exact mean between the parents, it would be comparatively easy, but they so often resemble one parent so much more strongly than the other, that clear indications of the second parent are hard to find. They exhibit all degrees of transition between the two parents, so that it is no matter of surprise that, before their rôle was fully understood, all our marsh orchids were regarded as forming one very variable species.

There is still the outstanding question as to whether there is in Britain a form of *latifolia* with unspotted leaves, distinct from *prætermissa*. I believed that I found such forms at Winchester and at Broadstone, but the rarity of unspotted *latifolia* in France makes me feel that this matter requires verification.

BIBLIOGRAPHICAL NOTES.

LXXXII. THE DATES OF RHEEDE'S 'HORTUS MALABARICUS.'

ERRORS in dates, like misspelled names, once committed to print, are difficult to get rid of. As a number of modern library catalogues have stumbled over the dates of Rheede's *Hortus Indicus Malabaricus,* it is apparent that some earlier records which explain the discrepancies are in danger of being overlooked.

Among a dozen catalogues examined, at least three uncritically accept the misprinted date 1673 for Pars iv.—nor can we assume that in all cases where inclusive dates are stated correctly, the intervening volumes have all been carefully scrutinized. While many cataloguers place their chief reliance on Pritzel's *Thesaurus,* one would suppose that their curiosity would be roused, at least, by finding the date for this volume given as 1683 in the second edition of Pritzel (1872–77), though the first (1851) gives it as "(errore) 1673 (1683)," an explanation unhappily omitted in the revision of the bibliography. Seguier (Bibl. Bot., 1740) and Miltitz (Bibl. Bot., 1829) merely give the correct date without comment. Dryander however (Cat. Bibl. Banks. iii. 179, 1797) gives it as "1673 (1683)," while Haller (Bibl. Bot. i. 589 (1771), says: "Tomus iv. De arboribus fructiferis malabaricis . . . 1683 (male 1673)." As definite proof that Pars iv. was actually published in 1683, one may cite the review of this volume in *Acta Eruditorum* anno MDCLXXXIV. (*i.e.* for 1683), p. 159, which quotes the title quite fully, though it gives the date 1683 without comment. Every copy of the *Hortus Malabaricus* ought to have this correction noted on the title of Pars iv. to avoid future confusion.

Beside the date of Pars iv., the work offers another stumbling block to the cataloguer in the title-page for the first volume. Although published in 1678, many copies do not have the original title, but the one dated 1686, which was reprinted verbatim from that of pars vi., but with the sole change of the volume number; hence we frequently find 1686–1703 carelessly given as inclusive dates for the entire work. Dryander (*l. c.*) explains the dates of pars i. as follows:—"Duae adsunt editiones Tomi 1mi, quarum utraque in titulo impresso habet annum 1678, sed in titulo sculpto, altera 1678, altera 1686." I have not been able to confirm this distinction between the printed and engraved titles; in copies I have seen both are alike, and judging from information in various catalogues, copies with both dates in the first volume cannot be common. Such a possibility, however, is suggested by the copy in the John Crerar Library of Chicago, with an engraved title dated 1682 in the first volume, though its main title-page has the original date 1678, while Pars iii. (1682) also has an engraved title of the same date, but not identical with that in pars i. Again, the Gray Herbarium of Harvard University has two sets of the first six volumes, with imprints varying considerably, though the dates are the same for the respective volumes, and in one of them Pars i. (1678) even has a totally different printer's device, a basket of flowers in place of the usual landscape enclosed by the motto: "Non aestas est laeta Diu, componite nidos." These examples indicate that almost any combination of dates might have been possible in early volumes.

Furthermore, the substitution of the 1686 title for that of 1678 (beside the absurdity of repeating the contents: "De varii generis Arboribus et Fruticibus Siliquosis" in place of "De Arboribus") is a slight upon the first editor, whose name appears only on the original title-page of Pars i.: "Notis adauxit, & commentariis illustravit Arnoldus Syen"—though he is eulogized by his successor Jan Commelin, in the preface to the second volume. Arnoldus Syen (1640–1678) was professor of medicine and botany at Leyden, but appears to have left little else in the way of botanical work save one short paper "De Herba Fumana" in *Acta Hafniensia*, iii. 103–105 (1675). His premature death occurred in the very year of the issue of the first volume of the *Hortus Malabaricus*, which might well be his chief memorial. Just how much credit is due to each of the editors and collaborators cannot be ascertained, but besides information given in the various prefaces of the work itself, there are considerable accounts of it in Phil. Trans. Roy. Soc. London, xiii. 100–109 (Mar. 10, 1682/3); Acta Eruditorum, 1648, 159–164 (Apr. 1684); and by Bertuch in Fortsetz. Allg. Teut. Gart. Mag. iii. 23–26 (1818), written as an introduction to Dennstedt's *Schlüssel zum Hortus Malabaricus*.

Bertuch indeed raises the question of earlier dates for certain volumes, citing the preface, dated December 1696, of Caspar Commelin's *Flora Malabarica*: "Prodierunt ante aliquot annos duodecim vasti istius operis *Horti Malabarici* titulo insigniti tomi." Commelin, moreover, definitely refers to every plate in all twelve volumes of the *Hortus Malabaricus*, although according to its imprint Pars xii. was not published until 1703. While it has been impossible to find any notice of issue, or locate any copy of earlier date, one may infer that inasmuch as Pars xi. was issued in 1692, the material for the remaining volume was all ready and even in print for some time previous to the issue of the title-page. Again, Haller (Bibl. Bot. i. 588, 1771) gives 1676 as date of the first volume, which is not followed by other bibliographers except Sprengel (Hist. Rei Herb. ii. 83, 1808); nevertheless the prefaces to this volume, which are all dated April 20, 1675, offer a reasonable presumption that printing must have begun long before 1678. With such evidences of diversity as have been presented, it seems not unlikely that copies or notices of publication may be in existence which would support these intimations of earlier dates, and it would be most helpful if anyone having such information would make it public.

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LXXIX a. Lehmann's Pugillus I.

In my notes on Lehmann's *Pugilli* (p. 108) much of what was said regarding the first of these requires correction. The statement, based on inadequate information, that no copy of the original issue existed at Kew proves to be inaccurate; and a consultation of this necessitates a revision of the third paragraph of my paper. The title-page of the Kew copy, which was presented to Bentham by Lehmann and bears an autograph inscription, runs:

"Index scholarum in Hamburgensium gymnasio academico in pascha 1828 usque ad pascham 1829 habendarum, editus ab Joan. Georg. Christiano Lehmanno (etc.). Continetur his plagulis pugillus novarum quarundam plantarum in botanico Hamburgensium horto occurrentium . . . . . Hamburgi, 1828."

The most important of the corrections necessitated by this discovery relates to the eight species of *Cacti*, which, in the absence of the original issue, I had concluded were first published in Nov. Acta, xvi. (1832) and interpolated by Lehmann in his reissue of *Pugillus* i. For this inference and what is based upon it there is no foundation; the *Cacti* appear in the original just where they did in the reissue, and my misleading statement would not have been made had I been aware at the time of writing of the review published in the *Literatur-Bericht* issued with *Linnæa*, vol. iii., to which Miss Alice C. Atwood, Bibliographical Assistant of the U.S. Department of Agriculture at Washington, has called my attention. The erroneous inference that the reissue was reset from the Nov. Acta was based on the fact that the copy of the volume of *Pugilli* in the Department of Botany—I have seen no other—which is apparently in the original binding, contains the plates from Nov. Acta, which of course were not in the original issue.

The note as to the plates (*op. cit.* xiv. 799) was, from considerations of space, somewhat abridged in my paper: in full, after "ex Indice" etc., it runs: "pugillum hunc plantarum, in Acta nostra translatum, figuris quarundam stirpium rariorum exornavimus, *Cactorum*, in eodem programmate illustratorum, historiam et effigies in proximum volumen Actorum reservantes." This, properly interpreted, makes it clear that the *Cacti* were in the original issue, from which they were separated only for the purposes of the Acta.

The four plates themselves present a certain puzzle which, although of no particular importance, may be briefly indicated. Although the Index Scholarum is dated 1828, the plates in Nov. Acta bear date 1827—the first "June," the fourth "July"; the first, second, and fourth are signed with a monogram "C. M."; the third is by a different (and much superior) hand; the name of the lithographer and printer are given, but the place of production is not stated. The four plates of the *Cacti* (Nov. Act. xvi. 1832) were printed in Breslau: the first was drawn by Lehmann, the remainder are by H. v. Meyer.

I had already noted the Kew copy of the original issue when I received the interesting communication from Miss Alice Atwood to which reference has already been made, wherein the errors corrected above were pointed out. With her letter she sends an account of the two sets of the *Pugilli* in Washington, "neither of them complete and both lacking the original *Pugillus*: the set in the Library of Congress consists of reissues, except for no. ii., while that in the Library of the Department of Agriculture is made up of originals—that is, of the *Pugilli* as they appeared in the programs of the Gymnasium." From this it seems that it would be of interest to know whether the original *Pugillus* exists elsewhere than at Kew.

James Britten.

SHORT NOTES.

The Name Alsine. In the *Kew Bulletin* (No. 19) Mr. T. A. Sprague discusses at length the history of this name, which has been applied to three genera—*Minuartia*, *Stellaria*, and *Spergularia*. After a careful examination of the literature, Mr. Sprague concludes that the type of *Alsine* is *A. media* L.; this "thus becomes synonymous with *Stellaria* L. [which] should be adopted under the International Rules. Under the American Code, however, the former name [*Alsine*] is adopted in accordance with the principle of 'priority of place,' in spite of six strong arguments in favour of *Stellaria*. This suggests that 'priority of place' as regards genera should be abandoned as leading to undesirable results." (It may be noted parenthetically that examples supporting Mr. Sprague's contention will be found in this Journal for 1890, pp. 296–8, at a period when the nomenclature of *Spergularia* was under discussion.) "*Alsine* Linn. emend. Gærtn. (1791) should be replaced by *Minuartia* Linn. (1753)." This was first pointed out by Mr. Hiern in a paper, to which Mr. Sprague refers, in this Journal for 1899, 320; his conclusions have been controverted by Dr. Moss (*op. cit.* 1914, 196 and more recently in Camb. Brit. Flora, iii. 32), but Mr. Sprague maintains Hiern's conclusions. "*Alsine* Linn. emend. Reichb. (1832) should be replaced by *Spergularia* T. & C. Presl (a *nomen conservandum* under the International Rules: the name *Alsine* thus disappears altogether."

Plantago Cynops L. in Kent (p. 271). It is evident that this species has maintained itself for a period of more than twenty years on the hills near Luddesdown. In 1902 I found it in a fallow field on the higher slopes of a hill between Cobham and Luddesdown, and then noted one old plant of apparently several years' growth, and, in the vicinity, several younger plants of various ages. During the year mentioned, flowers were very sparingly produced, my two examples, gathered on the 31st Aug., 1902, showing but two flower-heads between them. The locality remained uncultivated for years, but in 1905 had been brought under the plough, and the plant had disappeared. It is pleasing to know that it still exists in the neighbourhood. As to its status, there seems little probability of it being a native, and, judging from the locality in which it occurred in 1902, it most probably has been introduced with foreign seed.—C. E. Britton.

Euphorbia platyphyllos L. When John Ray was travelling through England he stayed at Bristol on two occasions, and among other discoveries found this plant, which he published in his *Catalogus Plantarum Angliae*, 1670, as—"Tithymalus platyphyllos Fuchsii, J. B. . . . Nos in Comitatu Somersetensi non longe ab oppido Kinesham copiosum invenimus." This proved to be a first record for Britain (see White, *Flora of Bristol*, p. 524). Keynsham is only 6 miles east of Bristol, and yet the Spurge had not been detected near that town until this autumn, when I found three or four good plants on neglected ground amongst modern buildings. It has been met with at rare intervals to the north of Bristol, and it is a satisfaction to know that after more than two hundred and fifty years it still exists in the old locality.—Ida M. Roper.

PRUNELLA LACINIATA IN KENT. Mr. W. R. Sherrin has kindly given me a specimen of the above, which he collected near Herne Bay in 1909. This appears to be an addition to v.c. 15. *P. laciniata* is now on record for the following nine counties:—Somerset N.! (v.c. 6), Hants S. (v.c. 11), Sussex E.! (v.c. 14), Kent E.! (v.c. 15), Surrey! (v.c. 17), Herts (v.c. 20), Berks! (v.c. 22), Cambridge! (v.c. 29), and Gloucester E. (v.c. 33).—C. E. SALMON.

SATUREJA MONTANA L. IN HANTS (p. 25). The occurrence of this plant at Beaulieu Abbey must have been surely well-known to botanists of a preceding generation. I have a sheet of specimens, duly named, collected by the late A. Grugeon at Beaulieu Abbey in Aug. 1873.—C. E. BRITTON.

ATRIPLEX CALOTHECA Fries "*A. hastata* L. Wg." teste Lindman, Svensk Fanerogamflora, p. 228 (1918). Mr. Lillie gathered this growing with *A. arenaria* Woods on the east coast of Caithness in Sept. 1918. These are the first certain specimens I have seen from Scotland.—ARTHUR BENNETT.

POA OMEIENSIS (p. 25). In creating this name, Dr. Rendle had overlooked his previous correction (Journ. Bot. 1908, 173) where he had substituted *P. szechuensis* for his *P. gracillima*. *P. omeiensis* is thus an abortive name.

REVIEWS.

ICELAND BOTANY.

The Botany of Iceland. Vol. i. pt. 6. The Lichen Flora and Lichen Vegetation of Iceland. By OLAF GALLØE. Vol. ii. pt. 1. Freshwater Diatoms. By ERNST OESTRUP. Copenhagen, 1919–1920.

GALLØE has divided his study of Iceland lichens into five sections:—(1) A list of Iceland lichens; (2) a discussion of the means of propagation; (3) the biology of lichens; (4) Ecology; and (5) the vertical distribution. It is the ecology of plants in an island subject to wind-storms and to extreme cold that offers most points of interest. The list of lichens gives us the subject-matter: it contains 285 species, among which the lichens of warmer regions and those that grow on trees are poorly represented: crustaceous rock-lichens and soil-lichens predominate. The author has added to each a statement of its presence or absence in Great Britain on the one hand and Greenland on the other. The large majority are to be found in our islands, though Dr. Galløe has credited us with species the record or which is unknown to our floras; and, at the same time, he has failed to note some of our quite common species. He is also somewhat inconsistent in his citation of authorities, giving sometimes only the earliest, as in "*Coniocybe furfuracea* L.," at others carefully relegating that authority to the usual bracketted position as "*Cladonia coccifera* (L.) Willd."

In the discussion on Ecology the "Associations" are divided into

(1) Bark-lichen, (2) Earth-lichen, and (3) Rock-lichen. Under these headings, which represent the substrata, he describes the occurrence of the lichens, the influence of the varying types of tree, soil, or stone, and the effect even in Iceland of variations of climates. Dr. Galløe considers that severe cold affects the growth of lichens adversely. This has not been altogether the experience of lichenologists in other regions. The boulders in Antarctic areas were found to be completely clothed with lichen vegetation; a great point in their favourable development was the absence of competition with other plants, an advantage which we are told is shared by the rock-lichens of Iceland.

In a previous part of the *Botany of Iceland*, Hesselbo gave much attention to the influence of hot springs on the moss vegetation in their neighbourhood (see Journ. Bot. 1918, p. 278). Some account of the lichens (if there be any) growing in these areas would have been of extreme interest, and it is to be regretted that the opportunity to discuss such an important ecological question has been missed.

As regards vertical distribution, the author concludes from his observations that lichens are least abundant where the cold is most severe: that both as regards the number of species and mass-occurrence, lichens are "very far from covering all the soil on mountain heights which is bare of all other competitors." He found that the same conditions prevailed in rock-lichens, there being fewer on the very high mountains than on the lesser altitudes. The paper abounds in original observation, and shows how much of interest is still to be learned about lichens and their habitats.

The special thanks of British students are due to the author for giving us his study in English. The reference (p. iii) to "Crombie, British Lichens, 1894–1911" requires correction. A. L. S.

Ernst Oestrup's posthumous paper on the Freshwater Diatoms from Iceland is based upon 572 samples of diatom-material, gathered by some sixteen collectors mostly in the east, south, and south-western parts of Iceland. The work is divided into two parts: (1) a systematic list with references to literature and giving descriptions of 57 new species and 13 new varieties which are all figured in the 5 plates; and (2) an alphabetical list with tables showing the distribution of all the 468 species and varieties in Iceland itself, and their wider distribution in the Arctic region and in the five continents of the world. The number of forms previously recorded for the island was 131; so its diatom-flora is now three-and-a-half times as large. In an appendix is a list of the forms collected in hot springs; these include 178 species and varieties, representing 31 genera, and for the most part they were found in the living state—that is, containing endochrome. A. G.

Water Plants, a Study of Aquatic Angiosperms. By AGNES ARBER, D.Sc., F.L.S. 436 pp. and 172 figures. Cambridge University Press, 1920. 31*s.* 6*d.* net.

IT is always interesting to see how Modern Botany of the Schools will approach the subject of the indigenous flora, and explain what there is to do when one knows the names of all the plants available. Since expansive accounts and an exhaustive nomenclature of critical sub-species have little interest for students brought up to contemplate the mutants of *Œnothera*, and the facile assumption of hybrids which rest on no experimental evidence does not excite those who are taught that such forms will Mendelize out. Floras devoting space to such conventions are obsolete before they are issued, and a working account of the biology and ecology of the living plant is a desideratum far beyond even the authentic herbarium-specimens of an Exchange Club.

Starting from the standpoint that the special plants of fresh-water streams and ponds are particularly available in the Cambridge district, Mrs. Arber has attempted a review of essentially aquatic types of flowering plant which may serve as a model for the examination and illustration of other biological groups of the British flora. As the author points out, no indigenous Angiosperm vegetation is so markedly aberrant from what passes as normal habit, as the regressive flowering plants of ponds and even of the sea; while in these days of rapid enclosure of woods and common land, and the march of cultivation implied by improved agriculture, such aquatic stations alone tend to retain their original inhabitants comparatively unaffected, as well as ready of access to the casual botanist.

The text includes a very full description of the organization and habit of such plants as *Sagittaria*, *Nymphæa*, *Hydrocharis*, Potamogetons, Utricularias, and Water-Ranunculi, with chapters on their special anatomy, their flowers and fruits, physiological processes and ecology, taking the last term in its widest significance. In order to give a wider outlook, more striking exotic examples are touched on, as Podostemaceæ and the marine *Halophila* and *Posidonia*. More speculative sections introduce references to the 'Law of Age and Area,' and the 'Law of Loss'; though, as in the case of the 'Law of the Survivor of the Fittest,' it is doubtful whether one gains more than a definition of the terms employed. It is refreshing in such a volume to find systematy kept well in the background; for example, *Limnanthemum* is bracketed with *Nymphæa*. The text may run thin in places, as in the account of the floral mechanisms of the Nymphæaceæ, and in details of fruit and seed-formation, and there is an excusable bias for recording ancient history; but the volume covers a wide range of introductory work, and as such will be welcomed by the student of the British Flora as a standard compendium of information on aquatics.

The method of interpretation reflects the attitude in which students of the last generation have been taught to consider the mechanism of derivation and adaptation, however much one may wonder sometimes if the problem is stated the right way; since the 'Law of Loss' is but a corollary of the basis on which it has been possible to build the science of comparative morphology. A deep respect for authority, again, which is less required when one has the living plant to deal with, finds expression in the extension of the usual list of references to 65 pages, thus swollen by the addition of brief notes on the content and scope of the memoirs—a somewhat terrifying prospect to a beginner, to whom a few grains of personal observation are worth a ton of literature.

Mrs. Arber is to be congratulated on a pioneer work which will prove indispensable to the botanical student, as it may be also stimulating to a wide range of nature-students, following in the footsteps of Brunfels, whose sixteenth-century study of *Nuphar* has been utilized as a frontispiece. It is written in simple and graceful style, and is nicely printed; a special feature is found in the large number of figures, carried out in line-work, with often decorative treatment. Possibly one will get used in time to the price of recent publications of the Cambridge Press.

A. H. C.

BOOK-NOTES, NEWS, ETC.

John Reader Jackson, who died at his residence at Lympstone, Devon, on Oct. 28, at the age of 83, was for forty-three years Curator of the Kew Museums. Born at Chelsea on May 26, 1837, he went at an early age with his family to Canterbury. Here he became keenly interested in architecture, and in 1851 came to London with a view to taking up this as a profession. He was greatly befriended by Professor Thomas Bell, who introduced him to various folk of importance, among whom was Sir William Hooker, who in 1858 appointed him to the Museums in succession to Alexander Smith, who had retired through ill-health; in this post he remained until his retirement in 1901. Jackson's arrival at Kew synchronized with that of Oliver, who was at that time employed in the Herbarium of which he afterwards became Keeper, and who showed him much kindness, coaching him in botany, with which Jackson was comparatively unacquainted. One of the most amiable of men, Jackson's readiness to help all who asked his assistance has been suitably recognized in all the notices of him that have appeared, as well as in numerous books whose authors he had supplied with information. My own acquaintance with him began as soon as I arrived at Kew in 1869, and at once became intimate; we had many interests in common, and we continued to exchange letters almost up to his death. Devoted to his work, of which the Kew Museums remain a monument, he found time to contribute many papers and notes to numerous periodicals, including this Journal: in 1877 he published a new edition of Barton & Castle's *Flora Medica*, and in 1890 a volume on *Commercial Botany*. He also prepared the first edition of the Official Guide to the Kew Museums and assisted Oliver in the later issues. In 1868 he was elected an Associate of the Linnean Society. A portrait, with an appreciative notice, will be found in the *Journal of the Kew Guild* for 1902.—J. B.

William Harris, who died in Kansas City on the 11th of last October, was born at Enniskillen, Ireland, on 15th November, 1860. In 1879 he went as gardener to Kew, and in 1881 recommended by the Director to take charge of King's House Garden, Jamaica, under Mr. (now Sir) Daniel Morris, at that time Director of Public Gardens and Plantations. In 1887, when I succeeded Sir D. Morris, Harris was in charge of Castleton Botanic Garden; he served as

Superintendent in each of the five Gardens in the island, and was always thorough in his work, and a most loyal and helpful assistant. In 1908, on my retirement, Harris was made Superintendent of Public Gardens under the Department of Agriculture; in 1917 he was made Government Botanist, and in 1920 Assistant Director. He distinguished himself as a collector of specimens for the local Herbarium, and I gave him every opportunity to devote himself to this work. He spent his holidays in collecting tours, thus becoming acquainted with the flora in every part of the island. His journeys were sometimes arduous, and often lasted for several days in the bush; frequently the only shelter he could get at night was a negro's hut. In the last letter I received from him, dated 6th August, 1920, he told me that he had had a break-down in health, and was compelled to go on three months' sick leave. Later I heard that a trouble in the throat of which he had complained was cancer, and he had gone to the United States to consult a specialist: he went to his eldest son's home in Kansas City, where he died in hospital. By his death botanical exploration in Jamaica has suffered a severe loss, and I lose a personal friend who has always been very helpful, and particularly of late years in my work on the Flora of Jamaica. Harris is commemorated in the genera *Harrisia* (Cactaceæ) and *Harrisella* (Orchidaceæ), and in the specific names of many of his discoveries.—W. FAWCETT.

IN a handsome volume issued by Messrs. Longmans, Professor Geddes has published an account of *The Life and Work of Sir Jagadis C. Bose*, with portraits and illustrations (16*s*. net). Notices of Bose's earlier works—*Plant Response as a means of Physiological Investigation* and *Response in the Living and Non-Living*—appeared in this Journal for 1903 (p. 28) and 1906 (p. 245); his later books on the irritability of plants and on their life-movements are summarized by Professor Geddes, who also gives an account of Bose's other observations. To many the most interesting portion of the volume will be the narrative of the struggles for recognition that ended triumphantly in May last in Bose's election as a Fellow of the Royal Society, which, twenty years before, had rejected the paper containing his first results in plant response. The endeavour to deprive Bose of the credit of his researches, as presented by him, after the Royal Society's rejection, to the Linnean Society is not pleasant reading; Professor Geddes, who expresses the indignation generally felt at the period, must have been sorely tempted to give the name, which however many will be able to supply, of the physiologist who claimed to have anticipated Bose. The account of Bose's early struggles and later travels is written from personal knowledge in the graphic style of which his biographer is a master, and the book, apart from its scientific value, is very interesting reading.

AT the meeting of the Linnean Society on Nov. 4, Mr. H. N. Dixon communicated a paper on "The Mosses of the Wollaston Expedition to Dutch New Guinea." These mosses were not described with the higher plants, but have since been worked out and have proved of great interest. Although consisting of only some 60 gatherings, the collection contained types of at least two new genera, *Hymenodontopsis* and *Callistomium*, and more than a dozen new species including two new species of *Dawsonia*, a genus which is more highly represented in New Guinea than in any other part of its rather limited distribution. A further collection by the Rev. J. B. Clark, of the London Missionary Society, in the neighbourhood of Boku, British New Guinea, is also included, and contains ten new species, including a very beautiful *Pterobryella*, and other interesting things. A small species, probably of *Rhizogonium*, named provisionally *R. orbiculare*, may possibly represent the ancestral form of the Rhizogoniaceæ.

On p. 183 we called attention to an advertisement which offered to supply "one square foot of sod, containing numbers of the beautiful and interesting" sandhill form of *Pyrola rotundifolia*, and entered a protest against this wholesale extermination. An equally reprehensible announcement is made by Mr. Clarence Elliott of the Six Hills Nursery, Stevenage, who in his catalogue offers to supply *Primula scotica*, and says: "A very rare native, occurring only in the extreme north of Scotland. I made a special expedition to collect it last summer, and hold a fine stock." The matter is made worse by the fact that Mr. Clarence Elliott has certain claims to be regarded as a botanist.

Notes from the Edinburgh Botanic Gardens, No. 59 ("May," but dated by printer "10/20") is mainly the work of Mr. William Wright Smith, who contributes diagnoses of numerous new species of various orders, mostly from China, in the Edinburgh Herbarium, and a paper on Asiatic *Styracaceæ*: Mr. Spencer Moore describes a new *Erlangea* (*E. venustula*) grown in the Gardens from seed sent from East Africa.

The *Kew Bulletin* (no. 9) contains, besides Mr. Sprague's paper referred to on p. 294, "Notes on Uganda Fungi," and a paper on "Diseases of the Oil Palm in West Africa," by Miss E. M. Wakefield; and "Contributions to the Flora of Siam," by W. B. Craib.

The *Annals of Botany* (October) contains "Studies in Seed Germination" (*Cyclamen*: see Journ. Bot. 1918, 222) by A. W. Hill; "Adventitious Leaves of *Cyclamen*," by L. A. Boodle; "The Rôle of the Seed-coat," by F. Kidd and C. West; "Leaf-structure of Liliaceæ," by Agnes Arber; "*Clathosorus*, a new genus of Plasmodiophoraceæ," by C. Fernandsen and O. Winge; "Plant Invasions of New Zealand," by J. C. Willis; "Anatomy of *Selaginella*," by J. C. T. Uphof; "*Spirogyra colligata*, sp. n." by W. J. Hodgetts; "Anatomy of *Rhododendron ponticum* and *Ilex Aquifolium*," by M. F. Rivett; "*Besleria lutea* a new example of Water-calyx," by M. Drummond.

The response to the appeal to subscribers in our last issue has been so far satisfactory, and has been accompanied by so many kind expressions as to the usefulness of the Journal, that, although the deficit (which proves larger than was estimated) has not been met, we propose to continue publication during 1921 at the necessarily increased subscription of 22*s*. 6*d*. We shall be grateful to any of our readers who may be able to obtain additional subscribers or may be willing to become so. A list of those who have contributed towards the deficit will be printed in our January issue.

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A REVISED ARRANGEMENT OF BRITISH ROSES.

By Lt.-Col. A. H. Wolley-Dod.

The difficulties surrounding the naming of our species and varieties of Roses increase rather than diminish as I see a greater number of specimens, though I am convinced that a sufficiently prolonged study of them will show that they can usually be segregated into varieties of which the individuals sufficiently closely resemble one another to be satisfactory, which at present is not the case. But if this be done, either the Subgroups or even the larger Groups will have to be abolished. There is little doubt in my mind that varieties, for example, with slightly hairy leaflets, or with glandular-hispid peduncles may in many cases be linked to those which do not present these characters, and therefore now appear in different Groups. In other words, I believe we should be guided at least as much by general habit and appearance as by technical characters, but this will be difficult with dried specimens.

Most of the very detailed descriptions of Déséglise, Ripart, and others, even those of Woods, can hardly be other than those of an individual bush or specimen, which cannot be completely matched by any other. Some descriptions, on the other hand, are so short and vague that, in the absence of authors' types, it is impossible to say what they mean, and authors' types are often so small and scrappy as to be useless.

The more I see of Déséglise's herbarium, the more unnecessary confusion and mixture I see in it, and I fear I have been misled by many of his names. Yet I think few rhodologists will dispute that we have a large number of distinguishable forms, which can be more or less well segregated. The difficulty is that of deciding which features are of importance, the relative values of which also depend on the Group into which they fall.

In the subjoined paper the characters, which only touch on the main features, are drawn up partly from descriptions and partly from specimens named on good authority, though, as said before, I may have been misled by some of Déséglise's names. They are for the present, I fear, only provisional, until further study confirms or alters them. It seems more than likely that some of the Subgroups will have to be expanded, and others curtailed, but a satisfactory solution is almost beyond the powers of an individual.

I should be very glad to see any collection of Roses and to name them in accordance with these views, and still more glad to receive criticisms on the arrangement, or the names given to specimens. It is only with the help of such criticism and the advice of those who have studied the genus that progress can be hoped for, as there are many parts of the kingdom I am unable to visit in order to study the growing plants and their habits.

Finally, it is hoped that this expression of the difficulties, rather than suggestions for their removal, will not cause botanists to avoid the genus. Knowledge can only be obtained by study and experience, and if collectors would send me good specimens, not the ends of flowering shoots, which are almost useless, and study their local forms, being careful to distinguish individuals from those which prevail, a more satisfactory account might be drawn up.

In making this revision, I have altered the names of many individuals in my herbarium, and doubtless would now do so to others on which I have based my vice-county records, but I have only marked with a sign of doubt those which are more than usually doubtfully correct.

As the grouping may not be quite clear when set forth with all the species, varieties, &c., covered by the various subdivisions, I summarize them here for ready reference :—

- I. SECTION SYNSTYLÆ.
  - Group of R. arvensis.
- II. SECTION STYLOSÆ.
  - Group of R. stylosa.
- III. SECTION PIMPINELLIFOLIÆ.
  - Group of R. spinosissima.
- IV. SECTION PIMPINELLIFOLIÆ HYBRIDÆ.
  - 1. Group Pimpinellifoliæ × Villosæ.
  - 2. Group Pimpinellifoliæ × Eu-Caninæ.
  - 3. Group Pimpinellifoliæ × Rubiginosæ.
- V. SECTION CANINÆ.
  - A. Subsection Eu-Caninæ.
    - 1. **Primary Group of R. canina.**
      - i. Secondary Group of R. lutetiana.
        - A. Subgroup Lutetianæ.
        - B. Subgroup Transitoriæ.
        - C. Subgroup Dumàles.
        - D. Subgroup Andegavenses.
      - ii. Secondary Group of R. blondæana.
      - iii. Secondary Group of R. dumetorum.
        - A. Subgroup Dumetorum.
        - B. Subgroup Deseglisei.
        - C. Subgroup Aciculatæ.
    - 2. **Primary Group of R. glauca.**
      - Secondary Group of R. Reuteri.
        - A. Subgroup Reuteri.
        - B. Subgroup Subcaninæ.
        - C. Subgroup Coriifoliæ.
        - D. Subgroup Subcoriifoliæ.
    - 3. **Primary Group of R. tomentella.**
  - B. Subsection Villosæ.
    - 1. Group of R. pomifera.
    - 2. Group of R. omissa.
    - 3. Group of R. tomentosa.
      - A. Subgroup Tomentosæ.
      - B. Subgroup Scabriusculæ.
  - C. Subsection Rubiginosæ.
    - 1. Group of R. rubiginosa.
    - 2. Group of R. micrantha.
    - 3. Group of R. elliptica.
    - 4. Group of R. agrestis.

I. SECTION SYNSTYLÆ.

GROUP OF R. ARVENSIS.

Habit weak and trailing, prickles stout, leaflets pale green, often glaucous, peduncles long, glandular, sepals entire, styles in a very long quite solid column, with stigmas in an elongate head. The clusters of flowers overtop the uppermost leaves.

R. ARVENSIS Huds. Simply or nearly simply serrate leaflets, glabrous or very slightly hairy on midribs and petioles, and globose or broadly ovoid fruit. V.c. 13, 14, 16, 17, 29, 32, 39, 40, 41, 55, 58, 60, 80, 81.

f. *major* Coste. Stouter, more erect, many flowers in a cluster. V.c. 2, 3, 13 or 14, 17, 32, 62.

[f. *repens* (Scop.) is a weak form; I have not hitherto distinguished it, but it is doubtless common.]

f. *scabra* Baker. Glandular petioles, often spreading to midribs. V.c. 3, 13, 17, 34, 41, 55, 58.

Var. *ovata* (Lej.). Ovoid or elongate fruit, leaflets variable. I include forms of *major*, *repens*, and *scabra* if the fruits are of this form. V.c. 2, 3, 13 or 14, 17, 19, 36, 37, 62, 63 ?.

Var. *biserrata* Crép. Leaflets fully biserrate. V.c. 57.

Var. *lævipes* Gremli. Peduncles all or mostly smooth. V.c. 17, 18 ?, 19, 41 ?, 57, 62 or 65 ?.

f. *pilifolia* Borb. Leaflets pubescent all over the lower surface. V.c. 17.

R. arvensis × *systyla* (*R. dibracteata* Bast. non auct. britt.). Intermediate between the two parents, with very large white flowers. V.c. 5, 19 ?.

R. arvensis × *gallica* (*R. gallicoides* Déségl.). Stem and sometimes the fruit with glandular acicles or sessile glands. V.c. 36, 37, 38, 57.

II. SECTION STYLOSÆ.

GROUP OF R. STYLOSA.

Erect. Stout hooked prickles, styles in a glabrous column (but often loose), usually salient from a conical disc, with stigmas in a narrow conical or cylindrical head, long glandular peduncles not overtopping the uppermost leaves, rather large, dark, shining green leaflets, well spaced on the petioles, and pinnate sepals.

R. STYLOSA Desv. Rather broad leaflets, hairy on both sides, or at least rather densely so beneath, and white flowers. V.c. 8, 9, 11.

f. *corymbosa* Desv. (var. *opaca* Baker). Like type, but with smooth peduncles. V.c. 3 ?, 9, 13, 14.

Var. *stylosa* Baker. Large narrow leaflets, glabrous above, and thinly hairy beneath, sometimes on midribs only. Flowers rose. V.c. 1, 2, 3, 4, 6, 9, 11, 13, 15, 16, 17, 21, 22, 23, 24, 29, 31, 32, 34, 35, 36, 37, 41.

f. *leucochroa* (Desv. non auct. britt.). Flowers white, otherwise as in var. *systyla*. V.c. 3, 15, 17, 34.

Var. *ptychophylla* (Boulenger). Smaller, with smaller finer-toothed leaflets, white flowers which project above the uppermost leaves. V.c. 9.

Var. *lanceolata* Lindl. (sub *R. systyla*). Fruit globose, leaflets variable. V.c. 6, 17, 34, 36, Ireland.

Var. *evanida* Chr. Much smaller, peduncles only slightly glandular, often smooth, leaflets irregularly serrate. subglabrous, rarely thinly hairy on midribs, fruit globose. V.c. 3, 17.

Var. *virginea* (Rip.). Leaflets uniserrate, glabrous or nearly, peduncles smooth, flowers white, fruit globose. V.c. 3, 13, 34.

Var. *parvula* (Sauz. & Maill.). Near the last, but leaflets biserrate, more hairy, smooth peduncles, pink flowers and ovoid fruit. V.c. 17.

Var. *Garroutei* (Pug. & Rip.). Leaflets sub-biserrate, subglabrous, peduncles almost smooth, flowers pink, fruit roundish ovoid. V.c. 31, 34.

Var. *pseudo-rusticana* Crép. Large and strong, leaflets subglabrous beneath, deeply and coarsely serrate. V.c. 3, 5, 8, 9, 34.

III. SECTION PIMPINELLIFOLIÆ.

GROUP OF R. SPINOSISSIMA.

Dense very mixed armature, 7–11 small suborbicular coarsely uniserrate leaflets, globose fruit, simple sepals, and broad woolly head of stigmas.

R. SPINOSISSIMA L. Uniserrate, white flowers, setose peduncles and black fruit. V.c. 9, 15, 17, 38, 41, 80, Perth, 96.

f. *pimpinellifolia* (L.) differs only in smooth peduncles. V.c. 3, 6. 9, 10, 13, 16, 17, 22, 25, 28, 49, 65, 66, 96, Chann. Islds., Antrim.

f. *rosea* Koch (sub *R. pimpinellifolia*) is a pink flowered form. V.c. 16, 45, 49. Perth ?.

Var. *mitissima* (Gmel.). Almost unarmed, leaflets larger and more spaced, peduncles smooth. V.c. 42, 49, Kerry.

Var. *Ripartii* (Déségl.). Leaflets more or less biserrate, petioles and midribs glandular. V.c. 17.

R. RUBELLA Sm. Stem clothing of fine acicles only, fruit red. V.c. 66, 84 or 90.

IV. SECTION PIMPINELLIFOLIÆ HYBRIDÆ.

It is extremely difficult to segregate these hybrids into their correct parentage. The very state of hybridity obscures the Group characters, still more the specific or varietal ones, so that it is quite probable that some of the form names, and more so that some of the specimens have been referred to the wrong Group.

1. GROUP PIMPINELLIFOLIÆ × VILLOSÆ.

R. INVOLUTA Sm. Stem armature mixed, leaflets hairy and biserrate, peduncles glandular-hispid, and styles villous. I use the name as an aggregate only, to cover all the following forms.

f. *Smithii* Baker. Leaflets little biserrate or even simply so, glabrous above. thinly hairy beneath, sepals usually entire. V.c. 15, 57, 64, 65, 90, 100.

f. *Sabini* (Woods)=*R. Doniana* Woods. Prickles straight, leaflets fully biserrate, pubescent both sides, more or less densely so beneath, and often with subfoliar glands. *R. Doniana* is said to have more hairy leaflets, entire sepals and white flowers. V.c. 13, 14, 16, 38, 58, 62, 64, 65, 69, 79, 82, 83, 88, 90, 94, 96, 106, 108, Antrim, E. Mayo.

f. *gracilis* (Woods). A large plant, with main prickles falcate, leaflets like *Sabini*, and peduncles often cernuous. V.c. 21, 62, 70.

f. *Robertsoni* Baker. Main prickles curved, leaflets not fully biserrate, rounded and subobtuse like those of *R. spinosissima*, sepals pinnate, fruit subglobose, usually smooth. V.c. 17, 62, 66 or 67, Derry.

f. *gracilescens* Baker. A stout form, with large, fully biserrate, thinly pubescent, eglandular leaflets, petioles almost eglandular, flowers many in a cluster, and fruit smooth, ellipsoid. V.c. Antrim.

R. SPINOSISSIMA × MOLLIS and R. SPINOSISSIMA × OMISSA. Several forms from Scotland, which do not fall readily into any of the above-named forms, have been referred direct to their aggregate parentage.

2. GROUP PIMPINELLIFOLIÆ × EU-CANINÆ.

Prickles mostly hooked, acicles usually few, leaflets uniserrate in most forms, some rarer ones with them biserrate, glabrous or only thinly hairy, peduncles usually smooth, sepals usually reflexed, fruit smooth, with hispid rarely villous styles.

R. HIBERNICA Templ. Prickles uniform, stout-based, leaflets uniserrate, thinly hairy on midribs and primary nerves, or the latter glabrous, peduncles smooth, fruit subglobose or broadly ovoid, sepals erect, pinnate, styles villous. V.c. 58, 65, 70, 82, 94, Derry, Down.

f. *glabra* Baker=var. *Grovesii* Baker. A form with glabrous leaflets. V.c. 17, 58, 63 or 65, 70, 94, 107, Antrim.

f. *Wilsoni* (Borr.)=var. *cordifolia* Baker. A small bush, with more mixed armature, main prickles almost or quite straight, leaflets large, uniserrate, oblong, emarginate at base, thinly hairy, peduncles glandular-hispid, fruit large, urceolate or subglobose, usually smooth, sepals entire, rarely pinnate, erect, rarely reflexed, styles very thinly hispid. V.c. 44, 68, Derry.

f. *lævigata* Baker=var. *Webbii* Baker. Leaflets fully biserrate, more hairy than usual, peduncles smooth, fruit subglobose, sepals subentire. V.c. 58, 64, 65, 83, Derry.

f. *Margerisoni* W.-Dod. Small, very like *R. spinosissima*, leaflets uniserrate, slightly hairy at least on midribs, peduncles smooth, flowers pink, styles villous. V.c. 64, 65.

f. *occidentalis* Baker. Very near the last, but with densely aciculate and glandular-hispid peduncles and pinnate sepals. V.c. Ireland.

3. GROUP PIMPINELLIFOLIÆ × RUBIGINOSÆ.

Known by their abundant and prominent fragrant subfoliar glands.

R. spinosissima × *rubiginosa* f. *cantiana* W.-Dod. (*R. biturigensis* auct. britt., non Bor.). Very mixed armature, the larger prickles stout but rarely hooked, leaflets suborbicular, fully glandular-biserrate, hairy on mid-ribs and primary nerves, more or less densely covered with subfoliar glands, peduncles and fruit glandular-aciculate. V.c. 15, 80, 82, 89.

f. *Nicholsonii* Crép. (sub *R. involuta*). I know this by its description only. Branches densely setigerous, leaflets medium, broadly oval or suborbicular, hairy on midribs and primary nerves, fully glandular-biserrate, peduncles and fruit glandular-setose. V.c. 91, 97.

f. *Moorei* Baker (sub *R. involuta*). Main prickles stout and curved, leaflets rather small, elliptical, acute. V.c. 96, Derry.

V. SECTION CANINÆ.

A. Subsection Eu-Caninæ.

This Subsection is so large, and contains such diverse species and varieties, that no author has succeeded in giving a comprehensive set of characters which will define it. Its members are perhaps best defined negatively by the absence of the distinctive features of the other Sections and Subsections.

1. Primary Group of R. canina.

Prickles uniform, leaflets uni- or biserrate, glabrous or hairy, styles very variable, sometimes resembling those of the *Stylosæ* in being salient and coalesced, but the stigmas are not in a narrow conical or cylindrical head, sepals reflexed and deciduous, rarely spreading and hardly ever suberect and subpersistent, always deciduous before the fruit ripens.

i. Secondary Group of R. lutetiana.

Leaflets glabrous, without subfoliar glands except sometimes on the midribs, petioles sometimes pubescent but not the midribs.

A. Subgroup Lutetianæ.

Leaflets simply serrate, not always quite uniformly, but none of the leaflets clearly biserrate.

R. LUTETIANA Lém. Whole plant usually eglandular, except rarely a few on petioles and edges of bracts and stipules, leaflets usually large, typically narrow oval with a rounded base, fruit ovoid often large, styles hispid, but varying from thinly so to villous. V.c. 3, 5, 8, 13, 17, 20, 22, 23, 24, 32, 33, 34, 36, 37, 38, 40, 45, 55, 62, 65, 69, 70, Antrim.

f. *viridis* Rouy (*R. lutetiana* typica). Leaflets green.

f. *nitens* Desv. Leaflets shining. Probably common. V.c. 36.

f. *glaucescens* Desv. Leaflets glaucous, petioles sometimes a little pubescent. Probably common. V.c. 58.

f. *fallens* (Déségl.). Petioles quite pubescent. Prickles straighter. V.c. 3, 17, 23, 36, 55, 57, 58, 69.

Var. *sphærica* (Gren.). Like the type but fruit subglobose or broadly ovoid, sepals sometimes spreading. Rarely the styles are glabrous. V.c. 1 or 2, 3, 14, 17, 22, 23, 32, 36, 50, 57, 58, 64, 80, 88, Down, Antrim.

Var. *separabilis* (Déségl.). Typically unarmed, leaflets of medium size, shining, coriaceous, fruit obovoid or ellipsoid, styles hispid. V.c. 3, 17, 23, 32, 36, 39, 42, 58, 62, 65, 88.

Var. *nemophila* (Déségl. & Ozan.). Leaflets large or medium, flowers rose, fruit ovoid, styles in an elongate fascicle, glabrous or nearly. V.c. 3, 7, 14, 17, 23, 24, 33, 57.

f. *flexibilis* (Déségl.). Prickles stouter and more hooked, leaflets more narrowed at the base, flowers white, fruit more elongate, styles quite glabrous. V.c. 3, 13 ?, 14 ?, 17, 29, 36, 40, 62, 80.

Var. *senticosa* (Ach.). Leaflets small or rather small, petioles often pubescent, fruit small, broadly ovoid, styles hispid, often only thinly so. Closely associated with its subvarieties and with var. *curticola* in the next Subgroup. V.c. 3, 16, 17, 21, 22, 23, 32, 33, 34, 35, 36, 40, 58, 59, 62.

f. *oxyphylla* (Rip.). Like var. *senticosa*, but leaflets small, rarely rather large, narrow, acute at each end. Fruit rather broadly ovoid, styles hispid. V.c. 17, 58.

f. *mucronulata* (Déségl.). Like var. *senticosa* but styles quite glabrous, fruit ovoid. V.c. 17, 23 ?, 33, 34, 65 ?.

f. *Amansii* (Déségl. & Rip.). Like var. *senticosa* but fruit quite globose. Its styles are hispid. V.c. 15, 16, 17, 36, 58, 63 or 64 ?.

B. SUBGROUP TRANSITORIÆ.

Intermediate between the last and next Subgroups. Leaflets mostly simply serrate, but some of them, especially the lower ones of the flowering shoots, distinctly biserrate, the primary teeth bearing 2–3 denticles which are often gland-tipped.

R. LUTETIANA var. *transitoria* R. Kell. = *R. insignis* Déségl. & Rip. As in type *lutetiana*, except for the incipient biserration. The petioles are often glandular. V.c. 3, 4, 17, 22, 23, 24, 31, 32, 34, 36, 55, 57, 58, 59, 60, 64, 69, 70, 80, Antrim.

Var. *rhynchocarpa* (Rip.). Fruit elongate-ovoid or obovoid, much constricted below the disc so as to be almost beaked. Leaflets normally large, but variable, styles glabrous or subglabrous. V.c. 17, 42.

Var. *globularis* (Franch.). Fruit subglobose or broadly ovoid, sepals often rising. V.c. 3, 5, 17, 22, 23, 32, 34, 36, 37, 55, 58, 60, 87, Antrim.

Var. *syntrichostyla* (Rip.). Leaflets small or medium, styles densely villous, usually salient. V.c. 2, 3, 5 ?, 17, 34, 36 ?.

Var. *curticola* (Pug.). Near var. *senticosa*, with small leaflets, small ovoid or subglobose fruit, and glabrous styles on a conical disc. V.c. 5, 14, 17, 34.

f. *ramosissima* Rau. This appears to differ from the last chiefly in its numerous short unarmed flowering branches. Its leaflets are larger and more narrowed at base, more uniformly serrate, styles more hispid and disc flatter. V.c. 17, 22, 23, 24, 32, 64.

C. SUBGROUP DUMALES.

These have all or most of their leaflets biserrate, not always strongly so, nor with the denticles always gland-tipped; they are without subfoliar glands. Their peduncles are smooth. The stipules, bracts and sepal edges, sometimes also their backs, show a greater tendency to develop glands than those of the two preceding Subgroups. Very compound gland-tipped biserration sometimes occurs, but this is a feature of the *Scabratæ*, which have, normally at least, subfoliar glands.

The Subgroup may have been too much subdivided, but its varieties are still very comprehensive and ill-defined.

R. LUTETIANA var. *dumalis* (Bechst.). The counterpart of *R. lutetiana* but with more or less biserrate leaflets, the fruit is usually ovoid or ellipsoid and the styles hispid, rarely densely so or subglabrous. V.c. 3, 5, 14, 17, 22, 23, 32, 33, 34, 36, 55, 57, 58, 62, 69, 78, 96, Derry, Antrim.

f. *rubelliflora* (Rip.). I see nothing in this but a bright red flowered form of the variety. Ripart credits it with fewer and straighter prickles, subsessile lateral leaflets and broad stipules. V.c. 3, 17, 33 or 34 ?, 57, 58, 65 ?.

Var. *sphæroidea* (Rip.). This differs from vars. *globularis* and *sphærica* only in its biserrate leaflets. The sepals, as in those varieties, show a tendency to spread. V.c. 3, 8, 17, 34 ?, 36, 58, 67, Antrim, Down.

Var. *biserrata* (Mér.). Leaflets of medium size, more strongly biserrate than in var. *dumalis*, fruit subglobose, and styles woolly. It is usually a more glandular plant, and has a tendency to spreading or even suberect sepals. V.c. 3 ?, 36, 40, 41, 42, 64, 69, 70, Perth, Down.

Var. *eriostyla* (Rip.). Very near the last, but a smaller bush with smaller fruit, sepals quite reflexed, and more exserted styles. V.c. 3 ?, 5, 31, 32 ?, 33 ?, 49 or 52, 70, 93, Down.

Var. *viridicata* (Pug.) is a comprehensive and ill-defined variety. It has rather small or medium-sized leaflets, not much biserrate, therefore not easily separable from varieties of the last Subgroup. Its styles are rather long and densely hispid, the fruit small, subglobose or broadly ovoid. V.c. 3, 14, 17, 21, 32, 34, 36, 37, 42, 55, 57, 58, 59 ?, 69, 70, Antrim, Down.

Var. *leiostyla* (Rip.) = *R. Chaboissæi* Gren. ? Like var. *dumalis* but with smaller leaflets and glabrous styles, often in a column. V.c. 3, 11 ?, 14, 17, 32, 49 or 52, 58, 62.

f. *glaberrima* (Dum.) differs from the last mainly in its subglobose or broadly ovoid fruit. Large leaflets, few prickles and white flowers are also assigned to it. V.c. 17, 40, 58.

Var. *Carioti* (Chab.). Leaflets small or rather small but broad, like those of *R. tomentella*, normally very prickly, but not always so, flowers white, fruit ovoid or urceolate, and styles glabrous. V.c. 3, 17, 36, 58, 67 ?.

Var. *stenocarpa* (Déségl.). Near var. *Carioti*, but leaflets and fruit much narrower, flowers rose and styles glabrous or subglabrous. It is said to be less prickly. V.c. 3, 17, 23, 31, 32, 36, 55, 57, 58.

Var. *adscita* (Déségl.). Leaflets small, fruit ovoid or ellipsoid, styles hispid, protruded from a conical disc, flowers white and many hooked prickles are its main features. V.c. 13, 17, 36, 40, 58, 65, 70.

Var. *recognita* Rouy is remarkable for its leaflets and fruit being elongate and narrowed at each end. Its styles are usually hispid, but sometimes glabrous. It might be regarded as an extreme form of var. *stenocarpa*, but with more hispid styles. V.c. 3, 17, 23?, 42, 58?, Down.

Var. *Schlimperti* Hofm. (sub *R. canina*). Leaflets rather large and rather narrow, usually narrowed at each end, fruit ovoid, styles glabrous or nearly so, and remarkable for its very rising or even suberect sepals, though they are deciduous. V.c. 42, 43, 58.

Var. *sylvularum* (Rip.). Prickles usually straightish, rarely hooked, leaflets quite small, fully biserrate, fruit subglobose, styles thinly hispid, rarely woolly. Resembles var. *senticosa*. V.c. 17, 58.

f. *parisiensis* Rouy is a form with very small fully biserrate leaflets, usually narrowed at each end, fruit ovoid, and styles glabrous or subglabrous. V.c. 16, 24, 26, 58.

D. Subgroup Andegavenses.

These are the varieties which have at least some of the peduncles glandular-hispid. The leaflets have all degrees of serration, but are without subfoliar glands.

R. lutetiana var. *andegavensis* (Bast.). Prickles often small and straightish, leaflets large, uniserrate, rarely slightly biserrate, variable in shape, typically elliptical and narrowed at each end, and well spaced on the petioles, fruit usually ovoid but variable, sometimes more or less glandular-hispid, styles hispid. V.c. 3, 13, 15, 17, 32, 34, 36, 38, 40, 57, 58.

f. *agraria* (Rip.). The only important difference is that the styles are glabrous or subglabrous. V.c. 3, 11, 13 or 14, 15, 16, 17, 22, 24, 57, 58, 68, 70.

f. *surculosa* (Woods). I think this is only a luxuriant state of the type, with stout hooked prickles and a tendency to form large clusters of flowers, of which the peduncles are often only slightly hispid. Fruit very variable, but described as ellipsoid, styles very thinly hispid. V.c. 13, 21, 22, 36?.

Var. *Rousselii* (Rip.). Leaflets suborbicular, uniserrate, fruit broadly ovoid, styles subglabrous. V.c. 17?, 34?, 55, 58.

Var. *litigiosa* (Crép.). Very short flowering branches, small uniserrate leaflets, small narrow ellipsoid fruit, and glabrous styles are the leading features. I do not feel satisfied that my specimens correspond, as they have broadly ovoid fruit, but they are nearest to this. V.c. 17?, 32?.

Var. *verticillacantha* (Mér.)=*R. inconspicua* Déségl. Leaflets biserrate, peduncles not much glandular-hispid and ovoid fruit not at all so, with hispid or subglabrous styles. The supposed prickle arrangement in a whorl is not peculiar to, nor indeed common in, this variety. V.c. 7 or 8, 22, 23, 32, 34, 38, 40, 58, 62, 65, 70, 99, Down?, Antrim.

f. *Lemaitrei* (Rip.). Leaflets smaller, fruit ovoid, and styles glabrous or subglabrous. Not easily separable from var. *verticillacantha*, or the less biserrate forms from f. *agraria*. V.c. 2, 10, 17, 33, 34, 58, 70.

Var. *Schottiana* Ser. (sub *R. canina*) differs from var. *verticillacantha* mainly in being almost unarmed, its leaflets also are more strongly biserrate, fruit ovoid and styles villous. V.c. 58.

Var. *aspernata* (Déségl.). Typically this should have its peduncles and fruit strongly armed with stout acicular setæ, many of them eglandular, but many forms with them only glandular-hispid have been placed here for want of a better name. Leaflets of medium size, biserrate, fruit normally ovoid, but in the aberrant forms globose, and styles hispid or subglabrous. V.c. 3, 17 ?, 23, 34 ?, 36, 58 ?.

Var. *latebrosa* (Déségl.). Stems with acicles in clusters here and there, leaflets rather small, biserrate, fruit ovoid and styles hispid. It may be a hybrid, though similar acicles appear in varieties of other Groups, the hybrid origin of which has not been suggested. V.c. 1 or 2, 3, 23, 35.

ii. Secondary Group of R. blondæana.

Leaflets glabrous, fully glandular-biserrate, often narrow, with subfoliar glands at least on primary nerves, rarely on mid-ribs only, peduncles smooth or glandular-hispid, fruit and styles variable. It is perhaps wrong to admit specimens without subfoliar glands, but these organs are often so elusive, and frequently appear only on a few leaves, that I have included forms without them on account of their very compound glandular biserration, and their strong resemblance to forms which have them. The Group includes Crépin's *Scabratæ*.

R. **blondæana** Rip. Leaflets large, sometimes broad, peduncles glandular-hispid, fruit subglobose and styles hispid. Rarely the fruit is ovoid, and forms exist with glabrous or with woolly styles. V.c. 34, 36, 38, 43, 57, 58, 62 or 65, 70, 89 ?, 105.

Var. *vinacea* (Baker). Leaflets typically narrow and well spaced on their petioles, peduncles smooth, fruit ovoid or ellipsoid, and styles hispid. Forms without subfoliar glands are frequent, and the position of the variety is doubtful, Baker having first credited it with subfoliar glands and afterwards making it a form of var. *biserrata*. V.c. 43, 58, 62.

Var. *Beatricis* (Burn. & Grem.). Leaflets small, often quite narrowed at each end. Normally very glandular, but British forms have few and inconspicuous subfoliar glands. Fruit ovoid or ellipsoid, styles subglabrous. V.c. 36, 40, 58.

iii. Secondary Group of R. dumetorum.

This includes all varieties of the Primary Group (*R. canina*), having hairy leaflets, even though the hairs are confined to the mid-ribs, but not those with pubescence on the petioles only. In some forms the sepals are spreading, and in one variety they are suberect, but their long peduncles and hispid, not woolly, styles will distinguish them from the *Coriifoliæ*.

A. Subgroup Dumetorum.

Peduncles smooth, leaflets simply or biserrate.

R. **dumetorum** Thuill. Leaflets hairy on both sides, fruit subglobose, styles usually densely hispid. V.c. 2 ?, 3, 8 ?, 13, 24, 32, 34 ?, 36, 65, 70.

f. *urbica* (Lém.). Very near *R. dumetorum*, but leaflets less hairy, usually glabrous above and thinly pubescent all over beneath, fruit ovoid, and styles hispid. Usually larger stronger bushes than in the type. V.c. 2, 3, 8, 17, 21, 23, 32, 34, 36, 37, 39, 43, 58, 62, 70.

f. *trichoneura* (Rip.) differs only in the pubescence being confined to the mid-ribs and primary nerves. V.c. 6, 13, 14, 17, 22, 27, 32, 34, 36, 40, 43, 50, 58, 70 ?, 78, 95, Derry.

f. *semiglabra* (Rip.) is still more glabrous, being pubescent on mid-ribs only. Its styles are more hispid, often villous. V.c. 3, 5, 6, 14, 17, 22 ?, 23, 32, 40, 57, 59, 62, 65, 70, L. Neagh.

f. *jactata* (Déségl.). Leaflets larger, irregularly serrate, thinly hairy beneath, usually on mid-ribs and primary nerves only. V.c. 17, 24, 31, 32, 55, 58, 70, 92 ?.

Var. *hemitricha* (Rip.) is thinly hairy and normally biserrate, but many subsimply and even simply serrate forms have been placed here by Déséglise—wrongly, I think. Its petioles are more often glandular than in the type. V.c. 3, 6 ?, 17, 21 ?, 23, 32, 34, 36 ?, 40, 57, 58, 59, 65, 70, 77 ?, 79.

Var. *Gabrielis* (F. Gér.). Leaflets smaller, often quite small and narrowed at each end, hairy on mid-ribs and primary nerves only, fruit ovoid or ellipsoid. V.c. 3, 14, 17, 31, 32, 34, 36, 40, 58, 59, 69, 88.

Var. *platyphylla* Chr. Leaflets large, very broadly oval or suborbicular, hairy on midribs and primary nerves; fruit large, ovoid, styles villous. V.c. 3, 13, 17, 19.

Var. *sphærocarpa* (Pug.). Near the type, but with broader less hairy leaflets, quite globose fruit, and thinly hispid styles. V.c. 3, 4, 17, 23, 24, 34, 41 ?, 58, 62, L. Neagh.

Var. *spinetorum* (Déségl. & Ozan.). Often unarmed, leaflets large, sub-biserrate, typically obtuse, fruit globose, styles densely hispid. V.c. 5.

Var. *ramealis* (Pug.). Peculiar in its elongate-ovoid or obovoid fruit, leaflets thinly hairy beneath. V.c. 17, 24, 31, 34, 58.

Var. *erecta* W.-Dod ined. Remarkable for its very long peduncles in clusters and suberect sepals. Its leaflets are irregularly serrate and thinly hairy, fruit ovoid, and styles hispid, sometimes densely so, but not villous. V.c. 17, 21 ?, 40, 43, 58, 70, 88 ?.

B. Subgroup Deseglisei.

These are the pubescent-leaved varieties without subfoliar glands, simply or subsimply serrate, and glandular-hispid peduncles, sometimes also the fruit. Some forms approach the *Stylosæ* and the *Coriifoliæ*, from which their Group characters should distinguish them.

R. dumetorum var. *Deseglisei* (Bor.). Leaflets normally small, but variable in size, broad for their length, hairy on both sides, rarely glabrous above, styles hispid, and fruit small, ovoid or roundish. V.c. 13 or 14, 23, 31 ?, 32, 36, 58, 65, 67, 68.

Var. *incerta* (Déségl.) has narrower leaflets, glabrous above and hairy on mid-ribs only beneath, usually somewhat irregularly serrate but not biserrate, and our forms are practically simply so, fruit larger, and styles usually hispid but varying to glabrous. Glabrous-styled forms have been labelled *R. leucochroa* by British authors, but their styles, prickles, and general habit serve to distinguish them. V.c. 3, 10 ?, 23, 32, 34, 36, 40, 55 ?, 56, 57, 58, 62, 67, 70.

f. *imitata* (Déségl.). Leaflets very thinly pubescent, fruit elongate-ellipsoid, and thinly hispid styles. V.c. 36 ?.

C. Subgroup Aciculatæ.

Like the last Subgroup, but with biserrate leaflets.

R. dumetorum var. *aciculata* Rouy (sub *R. canina*). By Rouy's key this should have long very prickly flowering branches, slender straightish prickles, small biserrate leaflets, hairy on primary nerves peduncles and base of fruit glandular-hispid and fruit ovoid. My specimen is peculiar for the presence of small acicles and gland-tipped setæ towards the ends of its flowering branches. V.c. 17 ?.

Var. *mercica* W.-Dod ined. Leaflets rather large, dark bluish green, more or less pubescent on both sides, peduncles usually rather strongly glandular-hispid, and sometimes also the broadly ovoid fruit, styles hispid. Forms with smaller leaflets, narrower fruit and villous styles occur. It has been miscalled *R. cæsia* in Britain. V.c. 57.

2. **Primary Group of R. glauca.**

The important characters are short peduncles, broad bracts and stipules, or at least auricles, and a broad hemispherical, rarely spherical, head of very villous stigmas, which hardly ever project above the narrow disc.

SECONDARY GROUP OF R. REUTERI.

This covers the glabrous-leaved varieties. The leaves are often glaucous, uniserrate or biserrate, and with or without subfoliar glands. The young shoots, stipules, and bracts are often reddish.

A. Subgroup Reuteri.

In these the sepals rise above the disc, or are even suberect after flowering, and persist till the fruit ripens.

R. REUTERI God.=*R. glauca* Vill. and *R. Crepiniana* Déségl. Prickles rather small, leaflets simply serrate, without subfoliar glands, petioles usually eglandular and unarmed, peduncles eglandular, and fruit large and ovoid. V.c. 16 ?, 34, 38, 40, 41, 57, 58, 59, 62, 65, 67, 78, 88, 91, Antrim ?.

f. *intricata* (Gren.)=var. *transiens* Gren. The only important difference is the glandular-hispid peduncles. V.c. 40, 57, 58, 98.

Var. *subcristata* Baker=*R. complicata* Gren. Leaflets more or less biserrate, very variable in size, petioles glandular, peduncles smooth, and fruit as in the type. Sometimes the sepals are very long persistent, so that the fruit resembles that of *R. mollis* Sm., and I have seen specimens so named. V.c. 17, 34 ?, 36, 38, 41, 43, 58, 65, 67 or 68, 69, 78, 79 ?, 88, 106, Down.

f. *myriodonta* Chr. is a strongly biserrate form, with more glandular petioles. V.c. 58, 106, Down.

Var. *fugax* (Gren.). Leaflets biserrate, not subfoliar-glandular peduncles glandular-hispid, fruit normally subglobose, but more often ovoid or ellipsoid in our forms. V.c. 36?, 58, 65, 81, 88, 98, Down?.

Var. *stephanocarpa* (Déségl. & Rip.). Leaflets biserrate, with subfoliar glands on the primary nerves, peduncles smooth, fruit broadly ovoid or subglobose. V.c. 57, 70, 88, Down.

Var. *œnensis* R. Kell. As in the last, but peduncles glandular-hispid. The leaflets vary much in size and shape in our forms. V.c. 40, 57?, 70, 88.

B. Subgroup Subcaninæ.

I define this Subgroup as having the characters of the Group of *R. Reuteri*, but with the sepals not rising above the disc, and often quite reflexed and deciduous, but this is neither Crépin's nor Keller's definition. The former credits it with hairy nerves, which would include it in the *Subcoriifolia* Subgroup, while Keller describes it as a series of varieties much nearer the *R. canina* Group than that of *R. Reuteri*. The absence of the most conspicuous feature of the Group makes its varieties difficult to recognise.

R. Reuteri var. *subglauca* W.-Dod. Like *R. Reuteri*, i. e., leaflets simply serrate, peduncles smooth, fruit ovoid, but sepals reflexed. V.c. 13?, 23?, 40, 69, 78?, 79?, 88.

Var. *montivaga* (Déségl.). Leaflets irregularly serrate, fruit subglobose. Though described as a *Canina* form, both description and specimens clearly indicate a variety of *R. Reuteri*. V.c. 36, 57, 60.

Var. *denticulata* R. Kell. This includes all the forms with biserrate leaflets, the other characters being variable. It therefore probably requires subdivision. V.c. 34, 58, 70, 88.

C. Subgroup Coriifoliæ.

The counterpart of the Subgroup *Reuteri*, with more or less hairy leaflets, at least on the mid-ribs. Its prickles are rarely stout, usually rather small but hooked, though sometimes long, rather slender, and curved.

R. Reuteri var. *coriifolia* (Fr.). Leaflets variable in size, simply serrate, hairy on both sides, or at least on the lower surface, without subfoliar glands, fruit subglobose. V.c. 39, 57?, 58, 62, 65, 69?, 70, 80, 88, Down.

f. *subbiserrata* Borb. (sub *R. coriifolia*) has its leaflets irregularly serrate or slightly biserrate. V.c. 3?, 38, 39, 57, 58, 92.

Var. *implexa* (Gren.). Leaflets often irregularly serrate, thinly hairy, often on mid-ribs only, without subfoliar glands, though Grenier has named examples with them on the primary nerves, sepals often less erect, connecting it with var. *subcollina*. V.c. 57, 58, 65, 88.

Var. *Bakeri* (Déségl.). Somewhat ill-defined both by Baker and Déséglise. Leaflets fully biserrate, rather densely hairy, often with a few subfoliar glands, typically narrowed at the base, but not always so, peduncles smooth or a little glandular-hispid, fruit ovoid, ellipsoid, or urceolate, smooth. V.c. 43, 62, 67, 69?, 70?, 88.

Var. *Watsoni* (Baker). Leaflets rather large, biserrate, variable in hairiness, but typically thinly so, without subfoliar glands, peduncles smooth, rarely with a few glandular setæ, fruit subglobose, ovoid, or urceolate, smooth. V.c. 40, 57, 58, 59, 65 ?, 69 ?, 70, 74, 78, 88.

Var. *celerata* (Baker). Leaflets small, broad and fully biserrate, like those of *R. tomentella*, glandular on primary nerves, peduncles smooth, fruit subglobose. V.c. 39.

D. Subgroup Subcoriifoliæ.

These have all the characters of the *Coriifoliæ*, but with sepals reflexed, or at most not rising above the disc. The absence of suberect sepals makes its varieties difficult to separate from some of those of the *Dumetorum* Group.

R. Reuteri var. *subcollina* Chr. (sub *R. coriifolia*). Leaflets simply serrate, rather large, narrowed at the base, hairy on primary nerves or on whole lower surface, without subfoliar glands, fruit large, described as roundish or a little ovoid, but more often ellipsoid in our examples. V.c. 17 ?, 70 ?, 88, 95, 98 ?.

Var. *cæsia* (Sm.). Leaflets grey-green, small, elliptical, narrowed below, without subfoliar glands, slightly doubly serrate, peduncles slightly glandular-hispid, fruit ellipsoid, smooth. V.c. Perth, 99.

Var. *incana* Borr. (sub *R. cæsia*). Prickles strongly hooked, leaflets very glaucous, fully biserrate, narrow, hairy both sides, with subfoliar glands, peduncles hairy, not glandular-hispid, sepals spreading or loosely reflexed, fruit large oblong. V.c. 95.

f. *subcoriifolia* (Barclay). Very near var. *incana*, but prickles less stout and less hooked, leaflets broader, less hairy, subfoliar glands very inconspicuous, sepals fully reflexed and fruit obovoid. V.c. 80 ?, 88, 90, 106, Antrim ?.

Var. *pruinosa* (Baker). Leaflets rather small but broad, glaucous, strongly biserrate, rounded or subcordate at base, peduncles smooth, fruit subglobose or ovoid, often small. V.c. 67, 70, 96.

Var. *Lucandiana* (Déségl. & Gill.). Leaflets large, oval, fully biserrate, rounded at base, moderately hairy, without subfoliar glands, peduncles smooth or glandular-hispid, fruit ovoid or subglobose. V.c. 3, 63, 70.

Var. *Lintoni* Scheutz (sub *R. coriifolia*). Near var. *Bakeri*, but with spreading reflexed sepals, leaflets elliptical, with more numerous subfoliar glands, subglobose fruit and smooth peduncles. The subfoliar glands in a specimen from the *locus classicus* are very difficult to see, as is often the case in very hairy leaflets. V.c. 88, 89, 91 ?, 92.

Var. *obovata* Baker (sub *R. tomentosa*). Prickles hooked, leaflets small, fully biserrate, obovate, obtuse, with subfoliar glands, peduncles smooth, fruit ovoid ?. V.c. 66, 106 ?.

3. **Primary Group of R. tomentella.**

Prickles normally stout and hooked, with broad bases, but more slender ones are admissible. Leaflets in most varieties small and broad, biserrate or simply so, always more or less pubescent and usually with subfoliar glands on the primary nerves, but often eglandular, sepals rather short, broad, and much pinnate.

R. TOMENTELLA Lém. Prickles variable, leaflets small, broad, rounded at base, hairy both sides, with subfoliar glands on the primary nerves, which are often difficult to see, fruit rather small, subglobose, styles hispid or thinly so. A small bush. V.c. 3, 16, 17, 21, 22, 23, 24, 32, 36, 40, 55, 57, 58, 62.

f. *decipiens* Dum. Like the type, but with glandular-hispid peduncles, leaflets often eglandular. V.c. 14, 16, 17, 23, 26, 33 ?, 34, 57, 58.

Var. *Carionii* (Déségl. & Gill.). Larger. Leaflets as in type, but not so broad, and longer, without subfoliar glands, flowers white, styles hispid or subglabrous. V.c. 3. 17, 19 ?, 23, 24, 32, 33, 34, 37, 56, 57, 58, 62 or 65.

Var. *Borreri* (Woods). Large and stout, with long internodes, prickles few, very stout and hooked, leaflets oval, thinly hairy, with or without subfoliar glands, peduncles often in large clusters, smooth or thinly glandular-hispid, fruit ovoid or ellipsoid, rarely subglobose. V.c. 3 ?, 13 or 14, 16, 17, 18, 21, 22, 23, 24, 31 ?, 32, 36, 40, 57, 58.

Var. *sclerophylla* (Scheutz). Prickles hooked but not stout, leaflets lanceolate, narrowed at each end, fully biserrate, subglabrous beneath, usually with subfoliar glands, peduncles smooth or glandular-hispid. V.c. 16 ?, 32, 36, 58, 62, 64.

Var. *Nicholsoni* Chr. Prickles rather stout but straightish, leaflets large, oval, subsimply serrate, slightly hairy but eglandular on primary nerves, fruit small, subglobose, peduncles occasionally slightly glandular-hispid, styles rather densely hispid. It is very near the *Deseglisei* Subgroup. V.c. 17 ?, 58 ?, 65.

Var. *Rothschildii* (Druce). Peculiar for the presence of acicles on the stems, not always present on all specimens. Leaflets oval, irregularly serrate, rarely glandular-biserrate, often only slightly hairy or subglabrous on the mid-ribs, subfoliar glands very variable, peduncles more or less glandular-hispid, sometimes smooth, fruit subglobose, styles subglabrous. V.c. 17, 31, 32.

Var. *obtusifolia* (Desv.). Like the type, but quite simply serrate, without subfoliar glands, and with white flowers. V.c. 2, 3, 4 ?, 11 or 12, 13, 14, 17, 34, 36, 40, 58.

f. *concinna* (Baker). As in var. *obtusifolia*, but with glandular-hispid peduncles. V.c. 3, 17.

B. SUBSECTION VILLOSÆ.

Prickles usually more slender and straighter than in the *Eucaninæ*, leaflets more constantly tomentose on both sides, and fully biserrate, often, not always, glandular on the whole lower surface, the glands often scented, but often inconspicuous and in some varieties absent. Peduncles usually glandular-hispid, sepals more or less erect and persistent, and styles usually woolly. Most of the exceptions belong to the Group of *R. tomentosa.*

1. Group of R. pomifera.

Of low growth, with straight stems and branches, prickles normally rather long, straight, and slender, sepals long and little pinnate, usually fleshy at the base and not disarticulating, but crowning the fruit till it falls. The leaflets are normally larger and more rounded at the apex, with more compound toothing than in the other two Groups, the auricles also are broader and falcately incurved towards the petioles, and the armature of the peduncles and fruit more aciculate.

R. pomifera Herrm. Leaflets very large, parallel-sided, said to be thinner than in *R. mollis*, with or without subfoliar glands, petals ciliate (?), and fruit violet when ripe (?). A doubtful native. V.c. 15, 34, 77 ?, 80, 91, 98, 106.

R. mollis Sm. Leaflets smaller and more oval, some subfoliar glands always present, but very variable in quantity and often hidden in the hairs, peduncles more or less densely glandular-hispid, but less disposed to be aciculate than in *R. pomifera*. V.c. 43, 57, 60, 62, 65, 66, 69, 70, 72, 73, 78, 80, 81, 85, 87, 90, Antrim.

f. *cærulea* Woods (sub *R. villosa*). Peduncles and fruit smooth or almost so. Woods says it is a smaller bush with more subfoliar glands. V.c. 52, 57, 66, 69, 74, 79, 81, 85, 88, 89, 96 or 97, 108, Antrim.

Var. *Grenierii* (Déségl.). All the characters of *R. mollis*, but without subfoliar glands. A parallel form to f. *cærulea* occurs. V.c. 36, 41, 42, 60, 62, 64, 69, 70, 75, 79, 80, 83, 92, 95.

Var. *pseudo-rubiginosa* (Léj.). Prickles usually few and very long, leaflets smaller, narrower, darker green and more glabrous, and more conspicuously glandular, sepals usually more pinnate. V.c. 17 (as an escape), 57 ?, 62, 66, 69, 78, 79, 88 ?, 89, 92 ?, Down.

R. mollis × *coriifolia*. Leading features of *R. mollis* f. *cærulea*, but with stouter, longer-based prickles, more pinnate sepals, and with appearance of the *Glauca* Group. V.c. 70.

2. Group of R. omissa.

Habit and technical characters just intermediate between the last and next Groups, making its varieties often difficult to assign to the correct one. The book characters, as compared with the last one, are stems and branches less straight, prickles more often unequal and curved, with larger bases, leaflets smaller and more acute, auricles more acuminate and not converging, sepals shorter and more pinnate, erect or often only spreading, not fleshy at base, persistent till the fruit is ripe, but not till it falls. In some varieties the styles are hispid, not woolly.

R. omissa Déségl. Prickles usually curved, sometimes straight, leaflets smaller, narrower, and more acute than those of *R. mollis*, with subfoliar glands, peduncles often only half as long as fruit, rarely as long, fruit subglobose, ovoid, or pyriform, smooth or slightly, rarely densely glandular-hispid, sepals shorter and usually less erect than in *R. mollis*. V.c. 33, 34, 36, 40, 41, 42, 54, 55, 57, 58, 65, 73, 88, 96, 106.

f. *resinosoides* (Crép.). Prickles fewer, stout and curved, leaflets with conspicuous subfoliar glands, fruit almost always glandular-hispid. V.c. 17, 36 ?, 43, 58 ?, 62, 65, 67, 70, 78, 79 ?, 80, 88, 89, 92, Antrim, Down, Mayo ?.

Var. *Sherardi* (Davies). Prickles stout, falcate, leaflets densely tomentose, broadly elliptical, often subsimply serrate, and usually without subfoliar glands, peduncles rather long, often in clusters, glandular-hispid, fruit smooth, subglobose or ovoid, sepals pinnate, suberect or spreading. V.c. 3, 8, 13, 14, 15, 16, 17 ?, 24, 27, 31, 32, 34, 38, 40, 42, 43, 57, 58, 70, 73, Down, Antrim.

f. *submollis* (Ley). Very near var. *Sherardi*, but prickles normally straight; leaflets fully biserrate, eglandular, peduncles longer, and fruit ovoid. Some author's specimens have quite falcate prickles. V.c. 14, 23 ?, 35, 36, 39, 40, 41, 43, 69, 70, 73, 78, 80, 91, 98, Antrim, Armagh ?, Down.

f. *eminens* (Harrison). Near *submollis*, but leaflets dark green, with subfoliar glands, peduncles and fruit smooth. I have seen no specimens. V.c. 66.

f. *uncinata* Lees (sub *R. tomentosa*). Prickles stout and hooked, leaflets of medium size, rather close-set, oval or broadly so, with some subfoliar glands on the primary nerves, fruit rather small, subglobose or broadly urceolate, smooth or nearly so, styles hispid, sepals dark-coloured, pinnate, spreading-erect. V.c. 36 ?, 40, 42, 49.

f. *pseudo-mollis* E. G. Baker (sub *R. tomentosa*). Very near f. *uncinata*, but prickles less stout and less hooked. V.c. 20, 22, 36, 42, 43, 80.

Var. *cinerascens* (Dum.). Prickles straight or curved, petioles eglandular, leaflets uniserrate, without subfoliar glands, fruit globose, more rarely ovoid, styles hispid, not woolly. V.c. 39, 57, 70, 88.

Var. *Woodsiana* H. & J. Groves (sub *R. tomentosa*). Prickles small, considerably falcate, leaflets narrow, dark green, thinly hairy, with some subfoliar glands, fruit narrowly ovoid, glandular-hispid or smooth, sepals long, dark, very glandular-hispid, with long pinnæ, styles hispid or thinly so. V.c. 17, 32, 65 ?.

R. SUBERECTA Ley. Prickles long, stout, straightish, often unequal, leaflets rather large, narrowly oval, dark green, but densely pubescent, usually with many subfoliar glands, sometimes few, very rarely absent, petioles densely clothed with pricklets, acicles, and glands, peduncles and fruit strongly glandular-aciculate, sepals broad, dark, densely covered with dark red glands, with long narrow pinnæ, fruit described as globose, but more often ovoid or broadly so. V.c. 49 ?, 56 ?, 59 ?, 62, 67, 69, 70, 78, 79, 92, 106, 108, Derry.

f. *glabrata* Ley is a glabrous-leaved form, with fewer subfoliar glands. V.c. 97, 105, 106 ?.

R. suberecta × *mollis* has intermediate characters, some specimens running very near *R. mollis* f. *cærulea*. V.c. 105 ?, 106 ?, 108.

R. suberecta × *coriifolia* is simply serrate with some of the characters of both parents. V.c. 106.

3. GROUP OF R. TOMENTOSA.

Habit of the *Eu-caninæ*, shoots not as a rule glaucous, prickles often but not always stouter and more hooked than in the last two Groups, leaflets paler, less bluish green, more often acuminate, peduncles longer, sepals usually reflexed, rarely somewhat spreading, deciduous before or as soon as fruit ripens, styles rarely more than hispid. In the Subgroup *Scabriusculæ* the leaflets are more glabrous, and the styles often quite so.

A. Subgroup Tomentosæ.

Leaflets usually densely and softly tomentose, styles quite hispid.

R. TOMENTOSA Sm. Prickles very variable, leaflets biserrate, eglandular, or with fine inconspicuous subfoliar glands, fruit ovoid or subglobose, sepals normally reflexed, but often spreading, rarely suberect, styles varying from densely to thinly hispid. V.c. 16, 17, 20 ?, 23, 27, 33, 34, 36, 38, 40, 42, 55, 57, 62, 67, 69, 74, 80, 81, 88, Antrim, Down.

Var. *cuspidatoides* (Crép.). Prickles straight, leaflets more glandular, fruit subglobose, styles decidedly hispid. V.c. 19 ?, 31, 39, 49, 55, 64, 65, 69, 70, 73, 78, 88, 106, Antrim ?.

f. *pseudo-cuspidata* (Crép.). Very near the last, but prickles somewhat curved, leaflets still more glandular, or at least more conspicuously so, fruit ovoid, and styles thinly hispid. V.c. 2, 3, 15, 17, 22, 23, 34, 40, 62, 65, 69, Antrim ?.

Var. *dumosa* (Pug.). Leaflets uniserrate, normally large, oval-elliptical, without subfoliar glands, long peduncles and ovoid fruit both glandular-hispid, styles woolly. V.c. 19 ?, 31, 49, 55, 70 ?, 73.

R. tomentosa × *glauca*. Intermediate between the two Groups. I have two forms, which are not identical. V.c. 70, 81.

B. Subgroup Scabriusculæ.

Leaflets much less tomentose (except in var. *confusa*), often subglabrous, sepals usually quite reflexed, and styles thinly hispid or glabrous.

R. tomentosa var. *scabriuscula* Baker. Prickles stout, but straightish, rarely falcate, leaflets large, elliptical, normally well spaced, but variable, thinly hairy and often rough to the touch beneath, with some subfoliar glands, peduncles long, fruit ovoid or ellipsoid, usually smooth, sepals reflexed, styles hispid. V.c. 3, 5, 6, 11, 16, 23, 24, 34, 36, 43, 48, 49, 58, 67, 70, 78, Derry.

Var. *confusa* (Pug.). Very near var. *scabriuscula*, but leaflets more densely tomentose and eglandular, sepals more spreading and subpersistent, fruit often hispid, and styles subglabrous. V.c. 16, 33 ?, 34, 36, 40, 50.

Var. *fœtida* (Bast.). Prickles of var. *scabriuscula*, leaflets oval, rounded or subcordate at the base, rather more pubescent and decidedly more glandular beneath, the glands, according to Bastard, smelling of turpentine, fruit ovoid, usually glandular-hispid, on long peduncles, sepals reflexed, and styles typically quite glabrous. V.c. 2, 3, 4, 11, 14, 16, 17, 24, 32, 34 ?, 39, 40, 53, 58, 62, Cork.

Var. *sylvestris* Woods. This has falcate or hooked prickles, leaflets narrow and more glabrous, usually with many subfoliar glands, styles thinly hispid, rarely glabrous. V.c. 3, 4 ?, 16 ?, 23, 24, 36, 38 ?, 44, 79.

Var. *britannica* W.-Dod = *R. Jundzilliana* Baker non Bess. Prickles numerous, long, stout, declining or falcate, rarely hooked, petioles strongly armed, leaflets large, densely tomentose, with many but often inconspicuous subfoliar glands, peduncles long, in a cluster, strongly glandular-hispid as well as the ellipsoid fruit, sepals dark, very glandular-hispid, loosely reflexed, styles glabrous, V.c. 32, 58.

C. SUBSECTION RUBIGINOSÆ.

Subfoliar glands very numerous, conspicuous, often sticky, and strongly scented. The other characters vary considerably.

1. GROUP OF R. RUBIGINOSA.

Low erect bushes, usually with unequal prickles, some of them often reduced to acicles in clusters on the stems, and especially below the inflorescence, leaflets small or rather small, roundish or oval, obtuse, rounded at the base, peduncles rather short, glandular-hispid (except in var. *Jenensis*), sepals spreading or suberect, subpersistent, stigmas in a short hispid or villous head.

R. RUBIGINOSA L. = *R. apricorum* Rip. Main prickles uniform, stout, and hooked, with acicles as in the Group, leaflets medium or small, pubescent at least on mid-ribs and primary nerves, fruit globose, less frequently ovoid, sepals spreading or suberect, but falling before the fruit ripens. V.c. 5 or 6, 11, 15, 17, 23, 24, 27, 32 ?, 37, 49, 69, 70 ?, 74, 78, 79, 80, 88, 89, 95, 96, Down.

f. *Gremlii* Chr. is a name given by Crépin to a white-flowered form, of which there several on the Continent. V.c. 89 ?.

f. *Corstophinæ* (Druce). So far as I know this, it is only a luxuriant form. V.c. 90.

Var. *comosa* (Rip.) has sepals erect and persistent till the fruit ripens, fruit usually ovoid. V.c. 3, 8, 9, 16, 17, 26, 27 or 28, 72, 78, 79, 80, 98, Down.

f. *comosella* (Déségl. & Oz.). Near the last, but with straight prickles. Leaflets sometimes as small as in var. *rotundifolia*, and fruit sometimes with long eglandular acicles. V.c. 17, Down.

Var. *echinocarpa* Gren. Prickles very numerous, the main ones hooked but not always stout, mixed with many smaller straight ones, peduncles and fruit with long eglandular acicles as well as glandular setæ, fruit large, broadly ovoid, sepals erect but not persistent, styles hispid. V.c. 15, 17, 27 or 28, Perth.

Var. *rotundifolia* Rau. A small bush with unequal straight, or only slightly curved, often long, prickles, and very small suborbicular leaflets, fruit rather small, subglobose or ovoid, smooth. V.c. 3, 9, 16, 17, 22, 40 ?, 62, 67 or 68.

Var. *Jenensis* M. Schulze. Like the type, but fruit and peduncles quite smooth. V.c. 15.

2. GROUP OF R. MICRANTHA.

Taller and less erect, like the *Eu-caninæ*. Prickles uniform, rarely with acicles under the inflorescence, leaflets larger, more acute, and often less glandular, fruit more urceolate, sepals reflexed, and styles glabrous, usually exserted.

R. MICRANTHA Sm. = *R. permixta* Déségl. Characters of the Group, leaflets variable in size, more or less pubescent beneath, rarely glabrous, usually reddish when young, fruit glandular or smooth.

V.c. 3, 4, 5, 6, 8, 10, 11, 12, 13, 14, 17, 20, 22, 23, 24, 26 ?, 32, 33, 34, 38, 55, 70 ?, 80.

Var. *operta* (Pug.). Prickles few, sometimes none, leaflets large, fruit ovoid, smooth. V.c. 3, 6, 23, 24, 32, 34.

Var. *septicola* (Déségl.). Prickles many, stout, hooked, leaflets large, fruit small, subglobose, somewhat glandular-hispid. V.c. 15.

Var. *trichocarpa* Rouy. Like the type, but with acicles below the inflorescence, leaflets oval-elliptical, and fruit roundish-ovoid, hispid. V.c. 11 or 12, 15, 16, 17, 33, 58.

Var. *sylvicola* (Déségl. & Rip.). Prickles long and straight, with acicles below the inflorescence. V.c. 3 ?, 27 ?, 31, 65.

Var. *hystrix* (Baker). Leaflets small, much narrowed at the base like those of *R. agrestis*, fruit described as elongate, but more often ovoid urceolate, small and somewhat glandular-hispid. V.c. 16 ?, 17 ?, 24, 32.

Var. *Lemanii* (Bor.). Near var. *hystrix*, but not synonymous, as Boreau supposed, since its leaflets are quite rounded at the base, and sometimes suborbicular. V.c. 6, 16, 17.

Var. *Briggsii* Baker. Leaflets normally very large, but forms occur with them normal, fruit and peduncles smooth. V.c. 3.

3. Group of R. elliptica.

Low erect habit of the *R. rubiginosa* Group, leaflets small, subobtuse, much narrowed at the base, peduncles rather short, smooth, sepals spreading or suberect, styles short, hispid, or villous.

R. elliptica var. *Billietii* (Pug.). Prickles stout, hooked, leaflets rather small, obovate, peduncles hairy, fruit ovoid or urceolate, styles villous or hispid. V.c. 6, 38.

Var. *cryptopoda* (Baker). Prickles hooked but small, leaflets glabrous above, thinly hairy beneath, rounded or only slightly narrowed at base, subfoliar glands inconspicuous, petioles almost eglandular. peduncles very short, fruit subglobose, styles in a woolly head. Déséglise places it in this Group, but it seems much nearer the *Coriifoliæ*. V.c. 63 or 64.

4. Group of R. agrestis.

Habit of the *Eu-caninæ*, though often dwarf in exposed situations. Leaflets narrowed at the base, peduncles rather long, smooth, sepals reflexed and deciduous, styles glabrous.

R. agrestis Savi=*R. sepium* Thuill. Prickles stout, hooked, leaflets small, often very small, narrow, and attenuate at each end, fruit ovoid, styles rarely slightly hispid. V.c. 6, 11, 17 ?, 23, Westmeath.

f. *subcuneata* Rouy. Leaflets larger, often but not always broader and more obtuse, fruit ovoid or ellipsoid. V.c. 6, 14, 15, 17, 22 ?, 23, 24, 34, 49, Westmeath, Lough, Dearg.

Var. *Belnensis* (Ozan.). Leaflets larger, broader, and more obtuse than in the type, fruit globose or subglobose. V.c. 6, 14 ?, 15, 17.

f. *pubescens* Rouy. Leaflets very large, 2 in. by 1¼ in., very pubescent, fruit ovoid. V.c. 14.

Erratum.—P. 3, line 7 from bottom, for *stylosa* Baker read *systyla* Baker.

THE MARINE ALGÆ OF GUERNSEY.

By Lilian Lyle, F.L.S.

I. Introduction.

The little island of Guernsey is well known for its rich harvests of seaweed, which at stated times of the year are gathered for fuel, manure, etc. Such fertility among the coarser kinds extends to those of more delicate structure, for, though naturally not so profuse, there is a wide range of species of considerable interest to the marine botanist.

Having spent several months of the years 1911, 1912, and 1914 in collecting round these coasts, my efforts were rewarded by the discovery of various species, new either to Guernsey, to the Channel Islands, or to Britain. It is therefore hoped that a revised list of all the known species of Guernsey Marine Algæ will prove of interest to students. The gatherings were made between March and November of the respective years, along the shore, among the rocks at low tide, or from a boat by means of a dredge—some specimens were found floating.

The results of an attempt to study the growth and distribution of the seaweeds of Guernsey from an ecological point of view are also given. They are very inadequate and far from complete. In 1914, I had intended making measurements and careful observations throughout the year, but after four months' work my plans had to be changed, owing to the outbreak of the War.

My thanks are due to Dr. Rendle, at whose suggestion this account was undertaken, and to Miss Lorrain Smith and Mr. Gepp, all of the Department of Botany, British Museum (Nat. Hist.), for their valuable advice and suggestions; to Mr. E. M. Holmes, for help in naming Algæ; to Mr. Paulson, for naming lichens; to Mr. and Mrs. Lemesurier, of Guernsey, for their interest and assistance in the matter of dredging; and to Captain Cameron, N.Z.S.C., for information regarding winds and tides affecting the Channel Islands. I was also indebted to the late Mr. Best, of Guernsey, for hints on the economics of Algæ.

Previous Lists.

The rich and varied marine vegetation of the Channel Islands has attracted the attention of many botanists. Of these the late Mr. Marquand is well known; his *Flora of Guernsey* (1901) includes 236 species of seaweeds found mostly by himself, together with lists of such earlier collectors as Greville and Le Lièvre. In 1908 he published still further additions to the Marine Algæ of Guernsey, making a total of 257 species for the island. A new edition of Holmes and Batters's *Marine British Algæ* appeared in 1902, in which Mr. Marquand's lists up to date were included. Dr. Van Heurck collected in the Channel Islands, more especially in Jersey, which he worked most thoroughly. His *Prodrome de la Flore des Algues Marines des Iles Anglo-Normands* (1908) contains Mr. Marquand's list for Guernsey, as also does Chalon's *Liste des Algues Marines* (1905).

In view of these exhaustive gatherings, it seemed almost hopeless that further search would yield any additional species. When it is remembered, however, that "some species are very uncertain in their appearance, occurring in abundance, perhaps, during one season and then disappearing for years," and when it is also borne in mind that currents and other agents frequently bring new species or their spores from long distances to establish themselves and even spread along our coasts—as, for example, *Colpomenia sinuosa*, *Bonnemaisonia asparagoides* v. *hamifera*, etc.,—one need never despair of making new discoveries. This was, indeed, my fortune, for I was able to find 46 species, 22 varieties, and 4 forms new to the Channel Islands; 46 species, 6 varieties, new to Guernsey; 3 species and 2 forms new to Britain; 1 species and 1 form new to science.

The total number of algæ for Guernsey, including those already listed by other workers is now 350 species, 78 varieties and forms.

Mr. Marquand throws some doubt on the existence of certain algæ mentioned in the lists of Miss Le Lièvre and Dr. Greville, or on their correct determination, as, after years of diligent search, he failed to find them. These are:—

Cystoseira barbata, *Fucus ceranoides*, *Sporochnus pedunculatus*, *Cutleria multifida*, *Sphacelaria Sertularia*, *Ectocarpus Mertensii*, *Daysa venusta*, *Nitophyllum Gmelini*, *Kallymenia Dubyi*, *Ceramium flabelligerum*, *Callithamnion arbuscula*, *Callithamnion roseum*, and *Cladophora repens*: also *Desmarestia viridis*, *Dictyosiphon fœniculaceus*, and *Rytiphlœa pinastroides* of Greville's list.

Cystoseira barbata is excluded from the British Flora by Batters as a waif. *Fucus ceranoides* is usually found in the estuaries of rivers. The absence of any large body of fresh water in Guernsey would tend to preclude the idea of its existence on these shores. *Cutleria multifida*, *Desmarestia viridis*, *Sporochnus pedunculatus*, *Tilopteris Mertensii* are all mentioned in Batters's *Marine Algæ* as growing in Guernsey, but they have not been found recently. *Callithamnion arbuscula* is an inhabitant of northern regions, and is replaced by *C. spongiosum* in the south: with the exception of localities where northern and southern floristic elements mingle—as, for instance, on the west coast of Ireland,—the two species never grow together. It is therefore hardly likely that *C. arbuscula* was collected in Guernsey, although *C. spongiosum* grows abundantly. *Nitophyllum Gmelini* and *Cladophora repens* are indicated by Marquand in his lists for Alderney, but they have not been found in Guernsey.

As regards the other missing species, Mr. Marquand suggests that they may have disappeared for a time to reappear later on. The fact that I was able to find five of them—*Schizymenia Dubyi*, *Ceramium flabelligerum*, and *Polysiphonia elongata* in 1911; *Halopithys pinastroides* in 1911, 1912, 1914; *Dictyosiphon fœniculaceus* in 1912; and *Sphacelaria Sertularia* in 1914—is in favour of his view. In no two years does it seem possible to find all the same Algæ.

I was able to find three of Mr. Marquand's four additions to the British Flora, viz:—*Streblonema Zanardinii*, *Liebmannia Leveillei*, and *Lithothamnion expansum*: but, though I searched diligently in the locality given and elsewhere, I was unable to find the fourth—*Polysiphonia opaca.*

II. Systematic List.

The following list includes all the species hitherto recorded, as well as those of my own gathering. To facilitate quoting localities, the island is divided into six districts, each locality being numbered as shown in the table below. The figures and initials in the square brackets refer to Mr. Marquand's lists:—

East.

1. Paradis Hommet.
2. Bordeaux.
3. Vale Coast.
4. Spur Point.
5. Pike's Corner.
6. Belgrave Bay.
7. North Beach.
8. Castle Cornet.
9. Bathing-place.
10. Fermain Bay.
11. Bec-du-Nez.
12. St. Martin's Point.

South.

1. Jerbourg Point.
2. Petit Port.
3. Moulin Huet.
4. Saint's Bay.
5. Petit Bot.
6. Les Tielles.

North-West.

1. L'Erée Bay.
2. Vazon.
3. Albecq.
4. Cobo.
5. Grandes Rocques.
6. Port Soif.
7. Port Grat.

West.

1. Pezèrie.
2. Les Portes.
3. La Varde.
4. Portelet.
5. Rocquaine Bay.
6. L'Erée.
7. Lihou Causeway.
8. Lihou Is.

North.

1. Grande Havre.
2. L'Ancresse.

South-West.

Pleinmont.

The classification and nomenclature coincide, so far as possible, with Holmes and Batters' *Catalogue* of 1902. Here and there, as indicated in the notes, the work of more recent algologists has necessitated certain changes—*e. g.*, the older generic name *Chantransia* has replaced *Achrochætium.* With regard to the calcareous algæ, I have followed Dr. Lemoine's classification as given in Mr. A. D. Cotton's Clare Island Survey (Proc. R. Irish Acad. xxxi. part 15: 1912).

The following abbreviations have been adopted throughout:—

E.=East. S.=South. S.W.=South-West. W.=West. N.W.=North-West. N.=North. M.=Marquand. H. & B.=Holmes and Batters. C.I.=Channel Islands (new to). G.=Guernsey (new to). B.=Britain (new to). c.=common. f.c.=fairly common. a.=abundant. l.a.=locally abundant. r.=rare. v.r.=very rare.

MYXOPHYCEÆ.

Coccogoneæ.

c.i. Aphanocapsa marina Hansg. N.W. 1. W. 4, 8. f.c.

c.i. Anacystis parasitica Kütz. (*Polycystis pallida* H. & B. Rev. List). On *Calothrix* sp. and *Cladophora* sp. W. 8.

g. Dermocarpa Leibleiniæ Born. On *Calothrix crustacea.* r.

g. D. prasina Born. On various algæ. c.

G. Pleurocapsa fuliginosa Hauck. N.W. 7.

P. amethystea Rosenv. [On *Clad. rupestris.* S. 2.] N.W. 7.

Hyella cæspitosa Born. & Flah. Indicated by Batters.

Hormogoneæ.

G. Spirulina subsalsa Œrsted. (*S. tenuissima* Kütz.). S.W. On *Corallina officinalis.*

C.I. S. subsalsa var. oceanica Gom. (*S. oceanica* Crn.). r. Among *Oscillatoria margaritifera.* S.W.

C.I. Oscillatoria margaritifera Kütz. (*O. insignis* Thw.). f.c. N.W. 7. S.W.

O. nigroviridis Thw. S. 5. On wet rock.

O. corallinæ Gom. (*O. littoralis* Carm.). c. [E. 2.] S.W. on *Corallina officinalis.*

C.I. O. amphibia Ag. (*O. infectoria* Tassi). W. 5.

C.I. O. lætevirens Crn. S. 2.

O. limosa Kütz. c. Muddy rocks. S.W. W. 5.

C.I. Phormidium tenue Gom. Among *O. margaritifera.* S.W.

C.I. P. corium Gom. S. 5. On wet rock.

G. Lyngbya æstuarii Liebm. Muddy sand.

L. majuscula Harv. [N.W. 4.] W. 1. c. In rock-pools on other algæ.

G. L. semiplena J. Ag. N. On rocks.

Symploca hydnoides Kütz. (*Calothrix semiplena* Harv.). [E. 10. N.W. 4, 5. On Corallines], and on clay mud. W. 1, 5.

C.I. Microcoleus tenerrimus Gom. On stones mixed with *Isactis plana.*

Calothrix confervicola Ag. [c.] N.W. 4. On other algæ.

C. scopulorum Ag. [W. 8. N.W. 4. E. 11.] W. 5. S.W.

C. pulvinata Ag. (*C. hydnoides* Harv., *C. pannosa* Harv., and *C. cæspitula* Harv.). [S. 2. N.W. 4. E. 12, 10.] On muddy sand and on algæ.

G. C. parasitica Thur. On *Nemalion lubricum.*

C.I. C. æruginea Thur. On other algæ. W. 4, 7.

C. crustacea Thur. c. N.W. 4, 6, 7. W. 1, 2. S.W. On rocks.

Isactis plana Thur. (*R. plana* Harv.). [N.W. 2.] S.W. Common On stones.

Rivularia Biasolettiana Menegh. (*Schizosiphon Warreniæ* Casp.). [E. 10. S. 2.] Common on stones and on *Corallina* sp.

R. atra Roth. c. W. 2. S.W. On rocks, limpet-shells, etc.

R. nitida Ag. (*R. plicata* Carm.). [S. 2.] N.W. 6. W. 5. S.W. On earth.

R. bullata Berk. (*R. nitida* Desmaz.). c. N. 2. On rocks, *Lichina pygmæa*, etc.

Mastigocoleus testarum Lagerh. Indicated by Batters.

C.I. Nostoc entophytum Born. & Flah. (*N. tenuissimum* Born.). Among *Calothrix crustacea.*

c.i. N. Linckia Born. & Flah. (*Monormia intricata* Berk.). Among *O. margaritifera*.

Anabæna torulosa Lagerh. (*Sphærozyga Carmichælii* Harv.). [N.W. 4.] On *Cladophora*, etc.

CHLOROSPERMEÆ.

Protococcinæ.

c.i. Codiolum Petrocelidis Kuck. In *Petrocelis cruenta*.

Confervoideæ.

c.i. Gayella polyrhiza Rosenv. (*Schizogonium disciferum* H. & B.). Pulias pool.

g. Pringsheimia scutata Rke. On *Chætomorpha* sp. Pulias pool.

g. Enteromorpha clathrata J. Ag. [Pulias pool.] N.W. 3, 4, 7. E. 2. On *Rho. palmata*, etc.—var. *gracilis* (Le Jol.). [M.] Indicated by Batters.

The Guernsey specimens of *Enteromorpha* have been named on broad lines and in a general sense.

It is interesting to observe how the germinating sporelings of *E. clathrata* grow into flat expansions one cell in thickness, over the surface of stones, before sending up erect filaments. The latter begin as little pimple-like elevations which appear here and there over the procumbent portions. A circle of cells elongates and arches over at the top; they increase in size and divide, until a tube of indefinite length is formed—its base, as is characteristic of this genus, being additionally strengthened by the downward prolongations of the cells composing the lower part of the tube. This tendency to become procumbent in the initial stages, is common to various algæ; it has been referred to by Yendo (Proc. R. Dublin Soc. ii. 105) and in my notes on "Developmental Forms of Marine Algæ" (*New Phytologist*, xvii. 231).

E. torta Reinb. (*percursa* Harv.). [Pulias pool.]

g. E. prolifera J. Ag. (=*E. compressa* var. *prolifera* Grev.). Pulias pool.

E. ramulosa Hook. var. *robusta* Hauck. [E. 2.] Var. *tenuis* Hauck. N.W. 7. W. 7.

E. compressa Grev. c. On *Fucus serratus* and on stones.

E. intestinalis Link. c.

E. Linza J. Ag. c.

Ulva lactuca var. latissima DC. (*U. latissima* J. Ag.) v.c.

c.i. Phæophila dendroides Batt. (*Ochlochæte dendroides* Crn. and *Phæophila floridearum* Hauck.) On *Stilophora rhizoides* and *Cer. echinotum*.

g. Bolbocoleon piliferum Pringsh. On *Cer. echinotum*.

g. Endoderma viride Lagerh. In *Poly. macrocarpa* and *Callithamnion* spp.

CHÆTOMORPHA TORTUOSA Kütz. (*Conferva tortuosa* Dillw. and *Chætomorpha implexa* H. & B.). [S. 2. E. 11.] N. 2. W. 4, 7. On *Chorda filum.*

C. LINUM Kütz. (*Conferva sutoria* Berk.). Pulias pool.

C. CRASSA Kütz. (*Conferva linum* Harv. non alior.) [E. 11.] N.W. 4.

C. AREA Kütz. [Batt.]

RHIZOCLONIUM KOCHIANUM Kütz. (incl. *R. implexum* Kütz.). Pulias pool.

G. R. RIPARIUM Harv. E. 7.

R. IMPLEXUM Batt. non Kütz. (*R. tortuosum* Kütz.). [S. 3, 5.] N. 2. N.W. 4.

C.I. CLADOPHORA PROLIFERA Kütz. E. 2. v.r.

C. PELLUCIDA Kütz. [N.W. 2, 4. S. 2.] W. 1. E. 6.

C. HUTCHINSIÆ Harv. S. 3. E. 7.—var. *divaricata* Harv. E. 6. r.—var. *distans* Kütz. (*C. diffusa* Harv.). E. 7. N. 2.

C. RECTANGULARIS Harv. E. 7. Thrown up.—(C.I.) var. *horrida* Kütz. (*Conferva Crouani* Chauv.). E. 7. v. 2.

According to Batters, *C. rectangularis* is very rare on the south coast of England; Mrs. Lane Clarke mentions having found it in Guernsey among *Zostera* beds. In 1911 and 1912, a few small pieces were thrown up, but in 1914 it occurred in greater abundance; in each case the specimens were taken from the *Zostera* beds north of the White Rock.

C. RUPESTRIS Kütz. c.

G. C. HIRTA Kütz. E. 3. One small specimen.

C. UTRICULOSA Kütz. (*C. lætevirens* Harv. partim). E. 2, 6. W. 1.—var. *diffusa* Hauck. E. 6. On rocks at low tide.

C.I. C. GRACILIS Kütz. E. 2.

G. C. SERICEA Kütz. E. 7.

G. C. GLAUCESCENS Harv. E. 2.

C. FLEXUOSA Harv. [E. 10. W. 5.] E. 2, 6. N. 2. N.W. 7.

C. ALBIDA Kütz. [E. 11.] E. 2, 10. W. 5.—var. *refracta* Thur. (*Conferva refracta* Wyatt, Alg. Danm. no. 228, *Clad. refracta* Harv. partim; *C. curvula* Kütz.). c. E. 2, 6.

C. FRACTA Kütz. [Pulias pool.]—var. *flavescens* Batt. (*C. flavescens* Harv. non Kütz.). [Pulias pool.]

C. REPENS Kütz. Indicated by Batters.

C.I. C. CORYNARTHRA Kütz. (var. *spinescens* Batt.). E. 7. Thrown up entangled among *Cl. rectangularis* and *Coral. rubens.*

C. ARCTA Kütz. [E. 11. N.W. 4.] S. 3.—(C.I.) var. *vaucheriæformis* Harv. S.W. 2.

G. C. LANOSA Kütz. S.W.

G. GOMONTIA POLYRHIZA Born. & Flah. In shells. N.W. 7.

SIPHONEÆ Grev.

G. OSTREOBIUM QUEKETTII Born. & Flah. In *Lith. polymorphum.*

BRYOPSIS HYPNOIDES Lamour. [Round the coast.] W. 5. N. 1.

B. PLUMOSA Ag. [S. 3. E. 2, 4.] E. 2.—(C.I.) f. *nuda* Holmes. S. 3.

Bryopsis plumosa flourishes from spring to late autumn, even lasting till December. Mr. Holmes's specimen of the f. *nuda* was gathered in September. The rank of variety which is given to it in H. & B. is doubtless an oversight.

The plant is an annual, and the form *nuda* is very probably only an old stage in which most of the pinnæ have disappeared previous to the dying away of the plant itself. Three small pieces were gathered in Guernsey about August, which had every appearance of being the remnants of mature plants.

Mrs. Gatty has observed that *B. plumosa*, when kept in aquaria, degenerates into a denuded form which is probably identical with *Derbesia Lamourouxii* Solier (*B. Balbisiana* var. *Lamourouxii* J. Ag.), figured in Kutzing, vi. t. 74.

CODIUM ADHÆRENS Ag. [S. 4.] N. 2. r.

C. TOMENTOSUM Stackh. v.c.

C. BURSA Ag. [S. 2, 3. Dec. '05.]

FUCOIDEÆ.

PHŒOSPOREÆ.

DESMARESTIA VIRIDIS Lam. H. & B. '02.

D. ACULEATA Lam. c. Thrown up from deep water, and on bulbs of *Sacchoriza*. N.W. 2. N. 2.

D. LIGULATA Lam. c. Low tide, quantities thrown up. [N.W. 4. S. 5.] S. 3.

DICTYOSIPHON FŒNICULACEUS Grev. H. & B. N. 1. Rock-pools.

LITOSIPHON PUSILLUS Harv. c. [E. 2, 10, 6.] W. 4, 7. On *Asperococcus fistulosus* and *Chorda filum*.

G. PHLŒOSPORA BRACHIATA Born. (*Ectocarpus brachiatus* Harv., *Stictyosiphon Griffithsianus* H. & B.). r. On *Rhodymenia palmata*. N. 1, 2.

PUNCTARIA PLANTAGINEA Grev. [N.W. 4.]

P. LATIFOLIA Grev. [S. 5.]

C.I. PHYCOLAPATHUM CRISPATA Batt. One specimen thrown up. N. 1.

PHYLLITIS FASCIA Kütz. (*Laminaria* Harv., *P. cæspitosa* Le Jol.). [N. 1, 2.]

SCYTOSIPHON LOMENTARIUS J. Ag. (*Chorda lomentaria* Lyngb.). [r.] E. 6. On stones.

C.I. COLPOMENIA SINUOSA Derb. & Sol. Twice found thrown up. E. 6. N.W. 4.

This plant is a native of the Indian Ocean. Good specimens were found on rocks at low tide at St. Peter's Port and Cobo. The distribution of the species and its appearance and growth along the southern shores of England have been fully dealt with by Cotton in Kew Bull. 1908, 11.

ASPEROCOCCUS FISTULOSUS Hooker (*A. echinatus* Grev.). c. [E. 6.] W. 4. On stones.

A. BULLOSUS Lam. (*A. Turneri* Hook.). [W. 4.] N. 2. E. 10. On stones.

STREBLONEMA FASCICULATUM Thur. r. In thallus of *Castagnea virescens.* [E. 10.] N.W. 7.—(G.) var. *simplex* Batt. In thallus of *Stilophora rhizoides* and *Nemalion lubricum.* E. 2, 3. W. 7.

S. ZANARDINII (*Ect. Zanardinii* Crn.). In thallus of *Chy. kaliformis.* [E. 6, 10.] E. 9.

ECTOCARPUS VALIANTEI Born. In thallus of *Cystoseira ericoides.* Mrs. Humber. N.W. 4. 1900.

E. VELUTINUS Kütz. (*Elachista velutina* Phy. Br.). [N.W. 4.] S. 6. On *Himanthalia lorea.*

C.I. E. GLOBIFER Kütz. (*Ect. insignis* Crn.). On *Castagnea virescens.* E. 8, 10.

E. MITCHELLÆ Harv. (*Ect. virescens* Thur.). ["In several places between E. 10 and S. 1."] On *Zostera.*

G. E. CROUANII Thur. (*Ect. fenestratus* Berk.). r. N.W. 3. On *Poly. affinis.*

E. CONFERVOIDES Le Jol. c. W. 3. On other algæ.—var. *arctus* Kjellm. (*Ect. arctus* Kütz. et *Ect. pseudosiliculosus* Crn.). c. and on *Sacch. polyschides.*

E. SILICULOSUS Kütz. c. E. 2, 10, and on *Lam. Cloustoni* and other algæ.

E. FASCICULATUS Harv. [N.W. 4. E. 2, 10. S. 5.] W. 5. On *Lam. Cloustoni* and *Sacchoriza polyschides.*

E. TOMENTOSUS Lyngb. E. 10.

G. E. HINKSIÆ Harv. On *Sacch. polyschides.* r. W. 1, 2.

E. GRANULOSUS Ag. [S. 2.] S. 3. On *Rho. palmata.*—(C.I.) var. *refracta* Batt. On *Zostera.* Dredged off E. 11. r.

E. SECUNDUS Kütz. [N.W. 4.] W. 1. r.

PYLAIELLA LITTORALIS Kjellm. a. and on *Asco. nodosum.*—(C.I.) var. *varia* Kuck. (*P. varia* Kjellm.). r. On *Asco. nodosum* and *F. vesiculosus.* E. 6.

The var. *varia* is an intruder from the north; its habitats are Invergordon, Isles of Cumbræ and Bute, Saltcoats, and Cromarty Firth. I found several well-grown specimens parasitic on *Fucus vesiculosus* and *Ascophyllum nodosum.* According to Batters, "this rare Alga forms loose entangled mats of a dark olive-brown colour, lying free on the bottom or hanging on other algæ. The fronds are decompoundly branched, the branches spreading at a wide angle; the lower branches are clad short and patent. The short branches, consisting of 2–10 cells, are frequently terminated by a solitary sporangium. The unilocular sporangia are terminal, frequently solitary, but chains of 2–10 are sometimes found side by side with the solitary ones."

MYRIOTRICHIA FILIFORMIS Harv. c. S. 3, 5, 7. On *Castagnea virescens* and *Asperococcus fistulosus.*

M. CLAVÆFORMIS Harv. On *Asperococcus fistulosus* and *Castagnea virescens.* E. 2, 8.

MYRIACTIS PULVINATA Kütz. (*Elachista attenuata* Harv.). c. On *Cystoseira ericoides.* [E. 2, 10. W. 7.] N. 1. W. 5.

M. STELLULATA Batt. (*Elachista stellulata* Griff.). On *Dictyota*. [E. 10.] E. 11.

ELACHISTA FUCICOLA Fries. On small algæ and *Fuci*. N.W. 4. N. 2.

E. FLACCIDA Aresch. On *Cy. granulosa* and *Cy. fibrosa*. [N.W. 5. S. 2.]

E. SCUTULATA Duby. [E. 10, 2. N.W. 5.] S. 6. On *Himanthalia*.

SPHACELARIA RADICANS Harv. [N.W. 2.]

S. OLIVACEA Pringsh. H. & B. '02.

S. CIRRHOSA Ag.—var. *pennata* Hauck. c. On *Corallina officinalis*, etc.—(G.) var. *fusca* H. & B. (*S. fusca* Harv.). E. 2, 7, 11. a. On vertical rocks.—(C.I.) var. *patentissima* Grev. r. Entangled among *Enteromorpha clathrata* and on shell of spider-crab. W. 1, 4. N.W. 7.

I have followed Batters in placing the var. *patentissima* under *cirrhosa*. Sauvageau, however, questions this, and points out that since neither propagulas nor spores have been seen on the plant it might equally be allied to *S. plumula*. Specimens have also been found to possess transverse divisions in the secondary articulations—a fact which would connect those plants with *S. plumigera*. He therefore concludes that the var. *patentissima*, usually attributed to *cirrhosa*, is a form which several species take when certain unknown conditions have produced parallel modifications, such as that of sterility. My own specimens have so much the appearance of *S. plumula* that it is difficult to distinguish between them; the resemblance is much closer than to *Sphacelaria cirrhosa*.

C.I. S. PLUMULA Zan. (*S. pseudo-plumosa* Holm. Fac. no. 24). Dredged, entangled among small algæ and on *F. serratus*. E. 8, 11. W. 4.

The characters which separate this from *S. plumigera* and *Chætopteris* are the absence of transverse septa in the secondary articulations of the branches, and the scarcity of rhizoidal filaments; those that occur lie close to the axis of the plant, but do not form a cortex. It is an inhabitant of the temperate zone in Europe, extending from the Mediterranean as far north as the southern shores of England.

CLADOSTEPHUS SPONGIOSUS Ag. c. E. 2. W. 4. On stones in sand.

C. VERTICILLATUS Ag. c. E. 2. S. 6. W. 4. On stones in sand.

HALOPTERIS FILICINA Kütz. (*Sph. filicina* Ag.). At low tide all round the island, but scantily distributed. [S. 2, 3, 5. N.W. 2. N. 2.] E. 11. W. 1.—var. *Sertularia* (Bonnem.) (*H. filicina* Kütz., *B. patens* Harv.). v.r. Entangled among *Ent. clathrata*. W. 5. N.W. 7.

STYPOCAULON SCOPARIUM Kütz. (*Sphacelaria scoparia* Ag.). c. Among *Zostera*.—(C.I.) var. *scoparioides* H. & B. (*Sph. scoparioides* Ag.). r. Entangled among *Ent. clathrata*. N.W. 7.

Myrionema strangulans Grev. c.—var. *punctiforme* H. & B. (*M. punctiforme* Harv. and *M. intermedium* Fosl.). On *Cer. rubrum.* [E. 6. W. 4.]

M. reptans Fosl. (*Ascocylus reptans* Reinke; *Chilionema reptans* Sauv.; *Hecatonema reptans* Sauv.). r. On *Saccorh. polyschides*, *Rhodochorton* sp.

G. *Hecatonema maculans* Sauv. On *Corallina officinalis.* r. N.W. 5.

C.I. *H. speciosum* Cotton. v.r. W. 5. On stipes of *Saccorhiza* and on *Desmarestia aculeata.*

The specimen was kindly determined by Mr. Cotton as identifical with the species collected by him at Clare Island.

Chilionema Nathaliæ Sauv. (*Myrionema Lechlancherii* Harv. pro parte). c.

Ascocylus orbicularis Magn. H. & B. "on *Zostera.*"

Ralfsia clavata Farlow. c. On limpets. [E. 2, 10. N.W. 2.]

R. verrucosa Aresch. [S. 3, 5. "With pleurilocular sporangia." N.W. 4, 5.] E. 11. S.W. Limpet-shells and small stones.

C.I. Spermatochnus paradoxus Kütz. (*Stilophora Lyngbyei* J. Ag.). r. N. 1. Floating and on *Cystoseira fibrosa.*

Stilophora rhizoides J. Ag. [N.W. 4, 5.] E. 10, 2. On *Cystoseira ericoides.*

Chordaria flagelliformis Ag. [N.W. 4. W. 7.] N. 1. W. 4.

Mesogloia vermiculata Le Jol. c. [S. 5. N.W. 4. E. 10, 2.] N. 1. On stones and other algæ.

M. Leveillei Menegh. (*Liebmannia Leveillei* J. Ag.). [E. 2.] N. 1. On stones.

C.I. M. lanosa Crn. One specimen. W. 7.

Castagnea virescens Thur. (*Mesogloia virescens* Carm.). c. [E. 3, 10. N.W. 4. W. 4.] S.W. E. 6. W. 5. N. 1.

C. Zosteræ Thur. (*M. virescens*, var. *zostericola* Harv.). N.W. 3. r.

C.I. C. contorta Thur. W. 1. r.

Petrospongium Berkeleyi Näg. (*Leathsia Berkeleyei* Harv.). c. N. 2. S. 2.

Leathsia difformis Aresch. (*Leathsia tuberiformis* S. F. Gray). a.

Sporochnus pedunculatus Ag. In H. & B. '02.

Chorda filum Stackh. c. Among *Zostera.*

Laminaria saccharina Lamour. c. On rocks.

L. digitata Lamour. c. On rocks.—(C.I.) var. *linearis* J. Ag. Pool form, half-tide. E. 6.

C.I. L. Cloustoni Edm. (*L. hypoborea* Fosl.). a.

This is a well-established inhabitant of the shores of the Channel Islands on the north and west coasts. As indicated by Cotton, the species "grows in about 15 fathoms of water, the stout and rigid stems being specially suited to the strong pull of the rollers in deep water."

The plants can be seen at extremely low spring tides, when the rough erect stipes forms a conspicuous feature of the sublittoral.

A few stunted specimens were found in pools at low tide.

SACCHORIZA POLYSCHIDES Batt. (*S. bulbosa* De la Pyl.).

ALARIA ESCULENTA Grey. H. & B.

ZANARDINIA COLLARIS Crn. (*Zonaria collaris* Ag.). [N.W. 2.] v.r.

CUTLERIA MULTIFIDA Grev. [Lelièvre].

AGLAOZONIA REPTANS Crn. (*Zonaria parvula* Grev.). [N.W. 2.] W. 4. On *Lith. polymorphum.*

FUCINEÆ.

c.I. FUCUS SPIRALIS L. (*F. Areschougii* Kjellm.). c.—var. *platycarpus* Batt. (*F. platycarpus* Thur.). c.

A definite zone of these algæ grows round the whole of Guernsey, interrupted only here and there by a sea-wall or by the absence of rocks at a suitable level. It is incomprehensible how *F. spiralis* can have been overlooked, as it occurs all along the coast, broadening occasionally into var. *platycarpus* according to the degree of shelter experienced.

F. VESICULOSUS L. c.—(c.I.) var. *evesiculosus* Auct. a. S.W. W. 1. On exposed rocks.

This is another plant which has escaped notice on the island. It is a distinctive feature in the flora of exposed regions, where it takes the place of *F. vesiculosus* and *Ascophyllum nodosum* of other localities. The plants are short and stout, about 4 inches in length, with thick leathery stems, firm and devoid of air-vesicles, as the name indicates; the colour is very dark, almost black.

F. SERRATUS L. c. On low rocks.

ASCOPHYLLUM NODOSUM Le Jol. a. W. 1, 7. N.W. E. 6.

PELVETIA CANALICULATA Dcne. & Thur. (*F. canaliculatus* L.). a.

BIFURCARIA TUBERCULATA Stack. f. (*Pycnophycus tuberculatus* Kütz.).

HIMANTHALIA LOREA Lyngb. l.a.

HALIDRYS SILIQUOSA Lyngb. l.a.

CYSTOSEIRA ERICOIDES Ag. l.a. N.W. 4. S.W. On stones and in pools.

C. GRANULATA Ag. [N.W. 4. N. 2.] E. 2. On stones and in pools.

C. FIBROSA Ag. N.W. 4. On stones and in pools.

C. DISCORS Ag. (*C. fœniculacea* Grev.). [E. 2, 10. W. 7, 5.] N.W. 4.

TILOPTERIDEÆ.

TILOPTERIS MERTENSII Kütz. (*Ect. Mertensii* Harv.). H. & B. '02.

ACHINETOSPORA PUSILLA Born. (*Ect. pusillus* Harv.). [S. 2.] S. 5.—(c.I.) var. *crinita* Batt. (*Ect. crinitus* Carm.). On *U. latissima.* E. 6.

Dictyoteæ.

Dictyota dichotoma Lamour. c. W. 7.—var. *implexa* J. Ag. (var. *intricata* Ag.). [E. 2. S. 2, 3.] W. 1.

Padina Pavonia Gaillon. [W. 4. N.W. 3, 4.] N. 2. N.W. 2.

Dictyopteris membranacea Batt. (*Haliseris polypodioides* Ag.). [E. 10. N. 1.] S.W. and E. 11. Dredged and in deep rock-pools.

FLORIDEÆ.

Porphyreæ.

C.I. Goniotrichum elegans Le Jol. (*Bangia elegans* Chauv.) E. 6. v.r.

Erythrotrichia carnea J. Ag. (*Bangia ceramicola* Chauv.). E. 11. on *Cer. ciliatum.*] On *Rho. Rothii.*

G. E. reflexa Thur. (*Bangia reflexa* Crn.). W. 1. v.r.

E. Welwitschii Batt. v.r. H. & B.

Bangia fuscopurpurea Lyngb. Batters. r.

G. Porphyra leucosticta Thur. N. 2. E. 6. N.W. 3.

P. linearis Grev. (*P. vulgaris* Harv.). E. 6.

P. umbilicalis Kütz.—var. *laciniata* J. Ag. c.—var. *umbilicalis* J. Ag. c.

The markedly scanty distribution of this species along the exposed and moderately exposed coasts of Guernsey during the summer and autumn months may be accounted for by the fact that *Porphyra* is said to be a winter and spring plant in the South of England. On the other hand, luxuriant growths in very sheltered conditions persisted through the summer and still flourished in November. There were also quite appreciable quantities in even moderately sheltered districts.

P. umbilicalis hangs down from the rocks and boulders, giving place to *P. laciniata* where there is shelter, on low rocks often half buried in the sand. Intermediate stages between the two forms show the relationship distinctly. Along the thallus little holes or slits appear, which by their extension lengthwise, cause the splitting up into the laciniate form. These transitions would seem to indicate that var. *laciniata* is developed from *P. umbilicalis*, possibly as a result of mechanical agencies, such as sand-friction and wave-action.

EufloridEæ.

Chantransia Schm. (*Achrochætium* Näg.).

These generic names were used by Bornet to designate the sexual and asexual conditions. As further research has shown the presence of sexual organs in an increasing number of species, Rosenvinge has united them all under *Chantransia*.

G. Chantransia virgatula Thur. E. 2.—var. *luxurians* Näg. [E. 12.]. E. 6. On a limpet-shell.—(G.) var. *secundata* Rosenv. E. 7. On other algæ.

C.I. C. corymbifera Thur. (*Achrochætium corymbiferum* Batt.). E. 11. N.W. 3. On *Cer. rubrum* and other algæ.

C. Daviesii Thur. [S. 4, 5. E. 10, 11. W. 7.] S. 4, 6. W. 1. N. 2. E. 11. On other algæ.

C. Lorrain-Smithiæ Lyle, sp. n. On stipes of *Saccorhiza polyschides*. W. 2. (Fig. 1.)

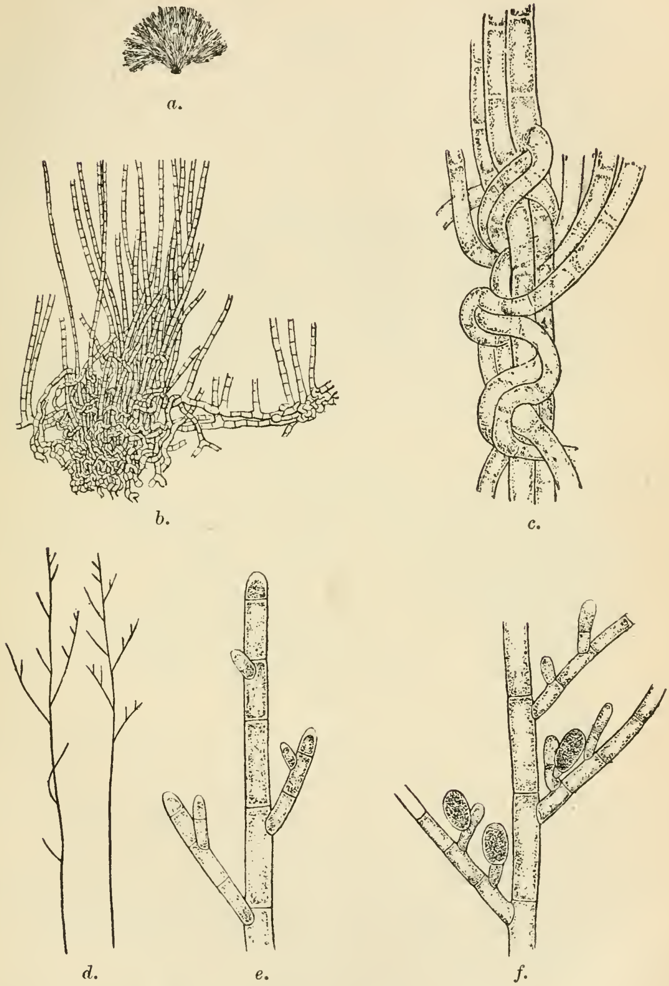

Fig 1.—*Chantransia Lorrain-Smithiæ*.

a. Tuft of plants, natural size.
b. Base of plants, showing rhizoidal filaments. × 80.
c. The same. × about 200.
d. Terminal branchlets. × 25.
e. The same. × about 200.
f. Monosporangia. × about 200.

Frondibus erectis, e strato pseudo-parenchymatico, decumbenti ascendentibus, copiosis, roseo-carnis vel pallide viriscentibus, 4–9 mm. long. Filiis sparse et vage ramosis, e articulis 45–60 μ long., 15–20 μ lat. compositis; ramis obtusis fastigiatis versus ad apices eorum ramos breves secundarios gerentibus; ramis secundariis 2–3 ramulos adaxiales pleurumque monosporangiferos 2–3 cell. longos emittentibus; monosporangies adaxialiter obvenientibus, ovatis, pedicellatis aut sessilibus, 30–35 $\mu \times$ 15–20 μ.

A luxuriant growth of this species was found on the stipes of *Sacchoriza polyschides* in October and November of 1912 and 1914, in an exposed region. The plant is assigned to the genus *Chantransia* on account of the monosporous reproduction and the basal disc of fusing rhizoidal filaments; it closely approaches *Daviesii*, but differs in the lax disposition of the sporangiferous branchlets which are situated towards the summits of the main branches, whereas in *C. Daviesii* the sporangiferous branches are longer, more numerous and crowded in or near the axils of the secondary branchlets on any part of the filament. The species is much more robust than *C. Daviesii* and possesses quite remarkably thick cell-walls. The absence of the terminal hairs is unimportant; Rosevinge points out that they are not of constant occurrence; some species never bear them and some only in their early stages.

G. NEMALION ELMINTHOIDES Batt. N. 2. N.W. 2. E. 3. On exposed rocks.

This is found at L'Ancresse on bare rocks dashed over by the waves at low tide. Yendo refers to this genus as one flourishing best where aeration of the water is perfect, *i.e.* when surrounded by white foam.

HELMINTHOCLADIA PURPUREA J. Ag. (*Nemalion purpureum* Chauv.). [S. 3, 5], and floating.

HELMINTHORA DIVARICATA J. Ag. (*Dudresnaya divaricata* Harv.). [S. 4, 5. E. 4.] N.W. 2, 3. N. 1. On other algæ.

SCINAIA FURCELLATA Bivona. (*Ginnania furcellata* Mont.). [N. 2. S. 2.]—(C.I.) f. *subcostata* J. Ag. Dredged off E. 11.

CHOREOCOLAX POLYSIPHONIÆ Reinsch. Mrs. Humber, 1902, on *Poly. fastigiata*; also N.W. 3, 4.

C.I. C. TUMIDUS Reinsch. On *Cer. rubrum*. r. E. 6. N.W. 4.

NACCARIA WIGGHII Endl. [W. 4.] N.W. 2, 4. N. 1. Floating.

PTEROCLADIA CAPILLACEA Born (*Gelidum corneum* vars. ϵ *capillaceum*, δ *uniforme*, et γ *pinnatum* Grev.). [E. 4.] S. 5. W. 3, 4. E. 2, 6. On rocks.

G. GELIDUM CRINALE J. Ag. (*G. corneum* var. *crinale* Auct.). E. 6.

G. G. PUSILLUM Le Jol. (*G. corneum* var. *clavatum* Grev.), et var. *cæspitosum* J. Ag.). W. 1. On rocks.

C.I. G. ACULEATUM Batt. (*G. corneum* var. *aculeatum* Grev.). W. 1, 4. E. 5, 7. On rocks.—(C.I.) var. *abnorme* Batt. (*G. corneum* var. *abnorme* Grev.). E. 7.

G. PULCHELLUM Kütz.—var. *genuinum* Batt. (*G. corneum* var. *pulchellum* Grev.). E. 8. W. 3. N.W. 4. f.c. In shady pools.—var. *setaceum* Batt. (*G. corneum* var. *setaceum* Kütz.). [E. 10.] E. 2.—(c.I.) var. *clavifer* Batt. (*G. corneum* var. *clavifer* Grev.). S.W.

c.I. G. ATTENUATUM Thur. (*G. corneum* var. *attenuatum* Hook.). N.W. 4, 7. W. 1, 4, 5. S. 4.

G. CORNEUM Lamour. W. 1, 3. 5.

G. LATIFOLIUM Born. (*G. corneum* var. *latifolium* Grev.; var. *plumula* Kütz.). [E. 2.] N. 2. W. 1. On rocks.—var. *Hystrix* n. f. *condensata* Holmes. S.W. (Fig. 2.)

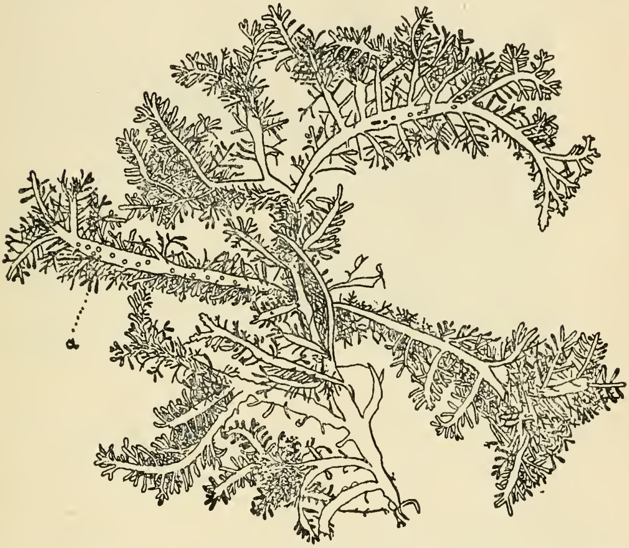

Fig. 2.—*Gelidum latifolium* var. *Hystrix* f. nov. *condensata* Holmes $\frac{2}{3}$ nat. size. *a*. Fruiting ramuli.

Ramuli simplices vel dichotome aut pinnatem divisi ad apices obtusi.

The form differs from the variety in the obtuse character of the short branchlets; a few fruiting ramuli are scattered over the surface. One specimen was found hanging from an overarching rock among huge boulders, and thus locally sheltered in an otherwise exposed position. It is curved in the upper part and measures 7½ centimetres. The ultimate branchlets measure a little over 1 mm. in length.

G. TORULOSUM Kütz. W. 3. (Fig. 3.)

This is new to Britain; it was described by Kützing as a new species (Tab. Phyc. Bd. p. 18, pl. 57. f. 1) as follows:—

Plant 2–3 inches in height. Fronds lax, very narrow, flat, irregularly tripinnate, or breaking up above; pinnacles opposite, patent, with constricted articulations. Cystocarps are borne on the terminal swollen branches. Native of Brazil; Chamisso.

De Toni has relegated this to a list of those species needing further investigation. The single specimen collected in Guernsey agrees fully with the above description.

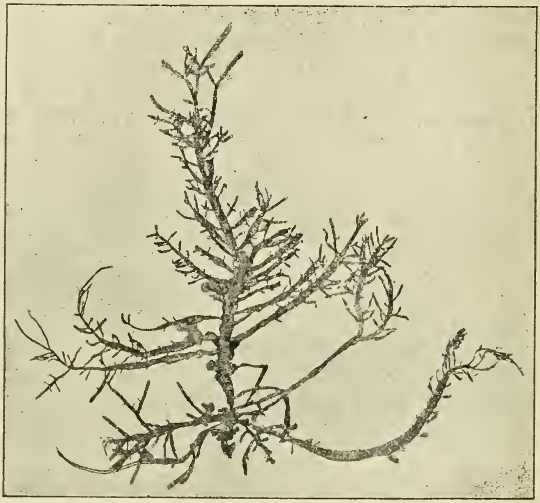

Fig. 3.—*Gelidum torulosum* Kütz. Nat. size.

CHONDRUS CRISPUS Stach. Everywhere. Rocks, stones, and among *Zostera*.—(C.I.) var. *æqualis* (Turn. pro parte). W. 5. —var. *filiformis* Turn. W. 4.—var. *patens* Turn.—var. *Sarniensis* Turn.—var. *lacerus* Turn., H. & B.

GIGARTINA ACICULARIS Lamour. S. 5. On rocks and bottom of rock-pools.

G. PISTILLATA Stackh. [S. 5, 3, 2.] W. 3. N.W. 2. Shallow rock-pools.

G. STELLATA Batt. (*G. mamillosa* J. Ag.). S.W. E. 5.

PHYLLOPHORA EPIPHYLLA Batt. (*Ph. rubens* (L.) Grev. [N.W. 4.] E. 6. W. 5, 7.

P. PALMETTOIDES J. Ag. [S. 5.] On *Lam. Cloustoni.*

P. MEMBRANIFOLIA J. Ag. [S. 2.] W. 4. On rocks.

GYMNOGONGRUS GRIFFITHSIÆ Martins. [S. 5.] W. 5. S.W. On small stones in sand.

G. NORVEGICUS J. Ag. [E. 10, 11. S. 3, 5.] W. 2. E. 5. On rocks.

C.I. G. PATENS J. Ag. r. N.W. 4. S.W. E. 6.

Hitherto the only British locality for this was Padstow, in Cornwall; specimens gathered in 1911 and 1912 at different stations show that it has now established itself on the shores of Guernsey. It grows at the base of low rocks under overhanging algæ.

Ahnfeltia plicata Fries. f. E. 2. S. 5. On stones in sand.

c.i. Actinococcus aggregatus Schm. r. On *Gymnogongrus Griffithsiæ*. S. 5. E. 3.

A. peltæformis Schm. r. On *G. norvegicus* and *G. patens*. S. 5.

g. Colacolepis incrustans Schm. On *Phyllophora epiphylla*. W. 2, 4. E. 1.

Callophyllis laciniata Kütz. f. E. 10, 6. W. 5, 1, 8. N. 2. On rocks.

c.i. C. flabellata Crn. E. 2, 11. Dredged.

g. Callocolax neglectus Schm. On *C. laciniata*. S. 3. E. 6. W. 1.

Callymenia reniformis J. Ag. r. [S. 5, 3. N. 2.] W. 4. S.W.—var. *Ferrarii* J. Ag. H. & B.

g. C. microphylla J. Ag. r. E. 2.

c.i. C. Larteriæ Holmes. r. E. 6. Floating.

Cystoclonium purpureum Batt. c. W. 8. On stones.

Catenella repens Batt. (*Catenella Opuntia* Grev.). c. E. 2. [E. 11. W. 7.] On sandy rocks.

Rhodophyllis bifida Kütz. f.c. E. 2, 7, 6. W. 1. On stalks of *Lam. Cloustoni*.

R. appendiculata J. Ag. [E. 2, 10, 11. N.W. 4.] N. 2. W. 2, 4 S. 6.

Sphærococcus coronopifolius Grev. [Fragments washed up at S. 5. E. 11.]

Gracilaria confervoides Grev. f.c. E. 2, 6, 10. S. 5. W. 3.

Calliblepharis ciliata Kütz. [E. 2, 10. N. 2.]

C. lanceolata Batt. (*Calliblepharis jubata* Kutz.). c. E. 2, 6. W. 4, 5. N.W. 7. S. 5.

Rhodymenia Palmetta Grev. [S. 5. E. 10. N. 2.] W. 5. S. 3. E. 1, 11.

R. palmata Grev. f. *typica*. c.—var. *marginifera* Harv. W. 5.—var. *sarniensis* Grev. [E. 2] E. 3. S.W.—var. *simplex* Harv. c.—var. *sobolifera* J. Ag. [E. 10, 11.] E. 5. On *Lam. Cloustoni*.

g. Cordylecladia erecta J. Ag. v.r. W. 5. In sandy pool.

Lomentaria articulata Lyngb. (*Chylocladia articulata* Grev.). c. On *Lam. Cloustoni* and on rocks.

L. clavellosa Gaill. (*Chrysymenia clavellosa* Harv.). [N.W. 4. E. 2. W. 5.] E. 6. N. 2.

Champia parvula Harv. (*Chylocladia parvula* Hook.). [S. 5. E. 2, 10. W. 4.] N. 2. W. 4.

Chylocladia kaliformis Hook. f.c. E. 2, 6. W. 1.—(c.i.) var. *patens* Harv. E. 10. W. 1.—var. *squarrosa* Harv. E. 2.

C. ovata Batt. (*Ch. ovalis* Hook.). f.c. E. 6. On stones.

C. reflexa Lenorm. [N.W. 4.] In a rock-pool.

Plocamium coccineum Lyngb. W. 1. E. 2. N. 2.

Nitophyllum punctatum Grev. [N.W. 4.] S. 3. E. 2, 6. On *Codium tomentosum*.—var. *ocellatum* J. Ag. [S. 3, 5. N.W. 4.] W. 1. N. 2.

N. uncinatum J. Ag. [E. 2.] E. 11, dredged. N. 1, in deep pools.

N. ramosum Batt. (*N. laceratum* Grev.). f. N. 2. E. 6. Rocks.—(c.i.) f. *ciliifera* Kütz. N.W. 4. W. 1.—(c.i.) f. *lobata* Kütz. E. 2, 5.—f. *reptans* (Crn.). Lyle in New Phyt. xvii. p. 231, n. comb. On *Laminaria* stipes, and *Lith. polymorphum*.—var. uncinatum Grev. (non *N. uncinatum* J. Ag.). N.W. 3. On *Corallina officinalis*.—var. *Smithii* Kütz. W. 8.

N. Hilliæ Grev. [E. 10.] N. 2. E. 2, 6. In shady pools, under ledges of rocks.

c.i. N. literatum J. Ag. In shady pools. W. 1.

g. Gonimophyllum Buffhami Batt. W. 5.

Phycodrys rubens Kütz. (*Delesseria sinuosa* Lamour.). [S. 3, 5. N. 2. N.W. 2.] W. 1. On *Lam. Cloustoni*.

Delesseria sanguinea Lamour. E. 6. N.W. 4.

D. alata Lamour. f. E. 6. W. 7. On stipes of *Lam. Cloustoni* and on rocks.

D. ruscifolia Lamour. c. S. 3. W. 6. On rocks.

D. hypoglossum Lamour. Not common. N.W. 4. On rocks.—(g.) var. *angustifolia* Kütz. E. 10. N.W. 3. On rocks.

Bonnemaisonia asparagoides Ag. Small specimens washed up. [S. 5.] N. 2. E. 11. Dredged.

There is a notice by H. Kylin, see Journ. Microscop. Soc. 1915, p. 604, of the occurrence of bladder-cells (Blasenzellen) in the thallus of *Bonnemaisonia asparagoides* and other Florideæ. These cells are filled with a homogeneous, colourless, strongly refractive substance, from which iodine is liberated on the death of the plant by the bursting of the bladders. "The iodine stains blue any starch solution, and leaves a blue mark on paper." The function of these cells is considered by the author as protective against small animals which eat algæ.

Rhodomela subfusca Ag. [E. 2, 10. N.W. 5.] W. 1, 4. Sandy stones and pools.—(c.i.) var. *gracilior* J. Ag. E. 6.

Laurencia obtusa Lamour.—f. *genuina* Hauck. [N.W. 4. W. 5. E. 2, 10.] W. 4. N.W. 7.—(c.i.) var. *crucifera* Hauck. W. 4, 5.—(c.i.) var. *pyramidata* J. Ag. N. 1.

L. cæspitosa Lamour. c. On stones, in shallow sandy pools.

L. pinnatifida Lamour. c. On rocks.—(c.i.) var. *tenuissima* Turner. One specimen on rock. S.W.

This was found in November among locally sheltering rocks in an exposed position. Dawson Turner's specimen of this variety is a very small plant, scarcely more than 1 inch in length and with mostly alternate branching. The Guernsey specimen is about 1½ in. in height and differs in bearing mostly opposite branches.

Halopithys incurvus Batt. (*Rytiphlœa pinastroides* Ag.). Dredged '11. W. 1, 4. a. In half-tide rock-pools and on rocks at low tide.

CHONDRIA TENUISSIMA Ag. (*Laurencia tenuissima* Harv.). [E. 6.] N.W. 4. In sand.

C. DASYPHYLLA Ag. (*Laurencia dasyphylla* Grev.). [E. 10, 3. S. 5. N.W. 4.] E. 2, 6. On stones in sand.

c.i. C. CÆRULESCENS J. Ag. v.r. S. 4. In a rock-pool at low tide.

A large and luxuriant patch of this rare alga grew in an extremely sheltered position in Guernsey. Its only other British habitats are Hastings and Felixstowe.

POLYSIPHONIA MACROCARPA Harv. (*P. pulvinata* Phy. Br. & *P. sertularioides* Holm. & Batt. Rev. List). [S. 2. E. 4.] S.W. S. 4. W. 1, 5. On *Lith. incrustans* and in chinks of rock.

Summer specimens are typical, those gathered in autumn are more robust, characterized by thickened filaments, darker in colour, much broken, densely tufted, and interwoven. Particles of sand, shells, etc., held in the interstices of the filaments afford a shelter for sporelings.

P. FIBRATA Harv. f. W. 1. S. 5. N.W. 3.

P. URCEOLATA Grev.—var. *typica* J. Ag. [S. 5.] E. 2, 5, 7. N.W. 4 W. 4. N. 1. f.—(G.) var. *patens* J. Ag. S.W. W. 1. S. 3. On *Lam. Cloustoni* and on rocks.—var. *formosa* J. Ag. (*P. formosa* Suhr.). W. 1.

G. P. ELONGATA Grev. W. 4, 6. E. 2. On stones in sand and ropes of lobster-pots.—var. *denudata* Grev. W. 2.

This seems to have reappeared recently. It figures in the old lists for Guernsey, but Mr. Marquand was unable to find it. Abundant specimens occurred in shallow sandy pools at Rocquaine Bay and Lihou in 1911: in the autumn of the same year the ropes of some lobster-pots at Pezèrie were profusely covered with f. *nuda*. Only a few old plants were to be seen in 1914; they were beginning to put forth new shoots.

P. VIOLACEA Grev. c. On rocks and other algæ.

P. FIBRILLOSA Grev. r. N. 2.

P. FASTIGIATA Grev. c.

In addition to its usual habitat on *Ascophyllum nodosum* this was found on *Fucus vesiculosus* var. *evesiculosus* in exposed localities.

G. P. CERAMIÆFORMIS Crn. v.r. E. 6. One small specimen.

P. SIMULANS Harv. [E. 4, 10. S. 3.] E. 2, 7, 8. N.W. 2, 3, 4. N. 2. Fringing deep pools.

P. OPACA Zan.—f. *simplicior*. [S. 2. In sand at half-tide level.]

P. NIGRA Batt. (*P. atro-rubescens* Grev.). [S. 2. N.W. 2.] S.W. E. 6. N. 1, 2.

P. OBSCURA J. Ag. [N.W. 2.] W. 4, 5. r. In sand.

P. NIGRESCENS Grev. c. [N.W. 4. S. 2. E. 10.] E. 2, 6, 8. W. 1, 3, 4, 5. N. 1. S.W. In sand.—var. *affinis* J. Ag. (*P. affinis* Moore). E. 2.

P. BRODIÆI Grev. [S. 5. N.W. 4. E. 10.] S. 2, 6. W. 1, 2, 4, 5, 7, 8. E. 2, 6. N. 1, 2.

P. SUBULIFERA Harv. [E. 6. S. 5.]

P. FRUTICULOSA Spreng. (*Rytiphlœa fruticulosa* Harv.). c. E. 2. W. 1. S.W. Among *Zostera*.—(B.) f. *Wulfeni* Kütz. W. 4. S. 6.

c.i. PTEROSIPHONIA COMPLANATA Schm. (*Rytiphlœa complanata* Harv.). S.W. One small specimen.

P. THUYOIDES Schm. (*Rytiphlœa thuyoides* Harv.). [S. 2, 3. E. 10. N.W. 2.] N.W. 1. E. 6, 9, 10. W. 5. N. 2. On *Bifurcaria tuberculata*.

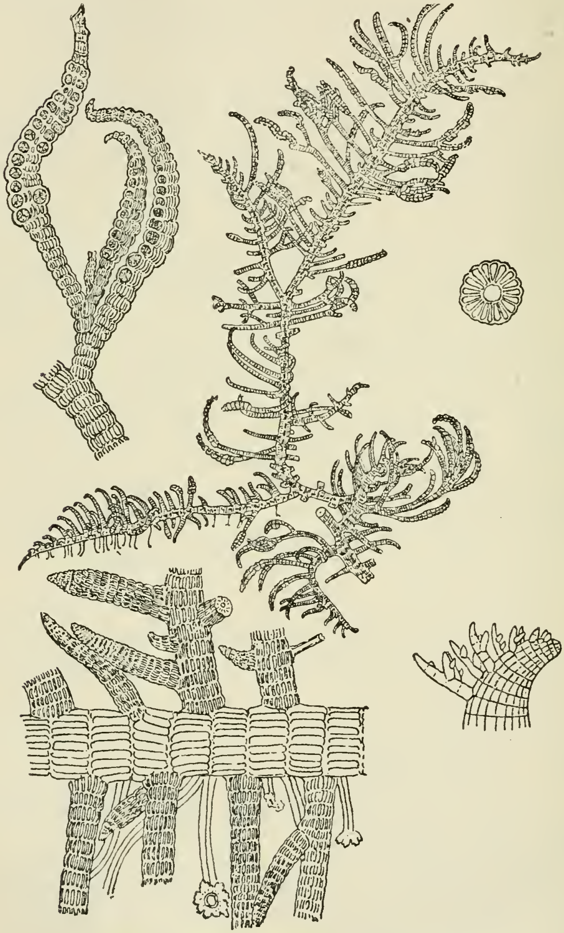

Fig. 4.—*Ctenosiphonia hypnoides* Falkenbg.

BRONGNIARTELLA BYSSOIDES Bory. (*Polysiphonia byssoides* Grev.). f. W. 1. S. 3. E. 2. N. 1. On rocks and *Rhod. bifida*.

B. CTENOSIPHONIA HYPNOIDES Falkenbg. (Polys. hyp. Welw.). Engl. & Prantl, Naturl. Pflanzenf. 1897, p. 466. (Fig. 4.)

Thallus prostrate and creeping, adfixed to the substratum by its under surface, rounded and gradually tapering. Apex incurved, ecorticate. Branching alternately on either side, and then afterwards irregularly. 12–18 pericentral siphons. Stichidia formed in the terminal segments of the branches, slightly incurved, enclosing a double longitudinal series of tetrasporangia. Cystocarps and antheridia hitherto unknown.

Ctenosiphonia differs from *Polysiphonia* by the arrangement of the tetrasporangia, which form two longitudinal series within the stichidium; on account of this, the genus approaches in a certain measure to *Halopithys*, but differs from it in the number of pericentral siphons. Colour, a dull purple, turning black when dry.

C. hypnoides was found in chinks of rock at half-tide in an exposed locality and is a new arrival on the coasts of Britain. Dense mossy tufts of dull purple filaments, about ¾ inch high, were closely matted and entangled; they measured 1–2 inches across and held sand, small shells, and stones in their meshes, serving as a shelter for spores of other algæ. The specimens were gathered in autumn, and did not show any reproductive bodies. The plant is a native of Spain, Portugal, and Morocco.

DASYA CORYMBIFERA Crn. (*Dasya venusta* Harv.). Miss Le Lièvre's list.

D. ARBUSCULA Ag. [E. 10, 11. N.W. 4.] E. 2, 6, 8. S. 2, 5. N. 2. N.W. 3.—(C.I.) var. *cæspitosa* J. Ag. S. 2.

HETEROSIPHONIA PLUMOSA Batt. (*Dasya coccinea* Ag.). c. S. 3. On rocks and stones.

SPHONDYLOTHAMNION MULTIFIDUM Näg. a. S. 3. E. 6, 8, 9. Hanging from rocks.

SPERMOTHAMNION TURNERI Aresch. (*Callithamnion Turneri* Ag.). f.c. Vertical rocks. [W. 5. N.W. 5. E. 2, 10.] S.W. W. 2, 4. S. 2, 5. E. 6. N.W. 4.—(C.I.) var. *monoica* Schm. (*Call. Turneri* var. *variabile* J. Ag.; var. *repens* Auct.; *S. roseolum* Pringsh.). S. 1, 2, 4. N.W. 1. W. 1, 5. N. 2. c. On *Fucus serratus* and *Furcell. fastigiata*.—(C.I.) var. *subverticillatum* Cotton. E. 11. v.r.

This was added to the British Flora by Mr. A. D. Cotton. Some small specimens were dredged at Bec du Nez in 1911 and 1912.

C.I. S. IRREGULARE Ardiss. v.r. E. 10. W. 3.

PTILOTHAMNION PLUMA Thur. (*Call. pluma* Ag.). [S. 5.] N.W. 5. W. 1. On *Lam. Cloustoni*.

GRIFFITHSIA CORALLINOIDES Batt. (*Griffithsia corallina* Ag.). f. N. 2. E. 2. On rocks.

G. FLOSCULOSA Batt. (*G. setacea* Ag.). c. E. 2. W. 1.

HALURUS EQUISETIFOLIUS Kütz. (*G. equisetifolia* Ag.). [N.W. 4. E. 2.] W. 2, 4, 7. On rocks.

BORNETIA SECUNDIFLORA Thur. (*G. secundiflora* J. Ag.). [N.W. 4. S. 3. E. 10, 11. W. 4.] E. 7. N.W. 3. On vertical rocks. (Fig. 5.)

A curious growth was gathered from a low-tide pool at Albecq. The median parts of the filaments are beset with a prolific number of downward growths. These descending processes emerge from any part of the filament cell, two may even be given off from the same cell; they are jointed, with blunt tips, somewhat paler in colour and about $\frac{1}{2}$ to $\frac{2}{3}$ narrower than the main branches; they are straight at first, but become wavy and irregular in their direction as length increases. The normal branching is pseudo-dichotomous. It is difficult to decide the significance of these appearances, which have not been observed before and may be merely the outcome of special conditions. The presence of colour and the form of the extremities preclude the idea of rhizoids. The descending growths have rather the appearance of runners or off-shoots, which, after extending to a suitable distance, may possibly develop rhizoids and give off new plants. Sexual reproductive organs have not been observed in this country; it is possible they occur during the winter months and have escaped discovery. The development of runners may, however, be a method of propagation either supplementary to, or even superseding, the sexual method. The fact that the plant spreads in ever-increasing tufts over the surface of the rock is in favour of this idea.

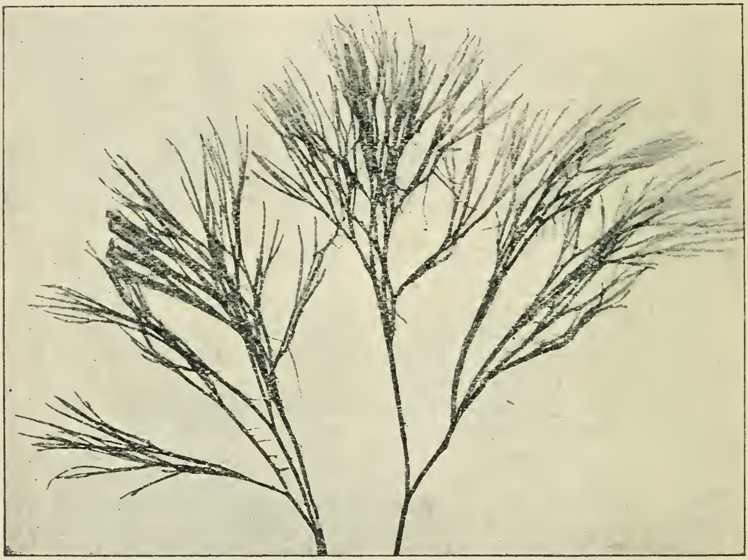

Fig. 5.—*Bornetia secundiflora* Thur.

Monospora pedicellata Sol. (*Callithamnion pedicellatum* Ag.). f. E. 9. W. 1, 5. On rocks.

PLEONOSPORIUM BORRERI Näg. (*Call. Borreri* Harv.). [E. 10, 11. S. 2, 5.] E. 5, 6.

RHODOCHORTON ROTHII Näg. c. S. 3.

R. FLORIDULUM Näg. [S. 2. N. 2.] S. 2. W. 1, 4, 5. In sand and on sandy rocks.

G. CALLITHAMNION TENUISSIMUM Kütz. r. E. 6. N. 1. S. 4.

C. BYSSOIDES Arn. [S. 3. N.W. 4.] E. 2. W. 1. On sides of rocks and other algæ.

C. POLYSPERMUM Ag. r. S. 4. On *Chondrus crispus.*

C. ROSEUM Harv. Miss Lelièvre.

C. DUDRESNAYI Crn. (*C. affine* et *C. purpurascens* Harv.). r. E. 2.

C. HOOKERI Ag. (incl. *C. lanosum* et *C. spinosum* Harv.). [E. 6, 2. N.W. 5. N. 1.] E. 2, 5, 10. N. 2. W. 1. S. 5. f.c. On other algæ.

C.I. C. BRODIÆI Harv. S. 4. E. 1. W. 8. r.

G. C. FRUTICULOSUM J. Ag. S.W. E. 2, 6, 10. r. On *Poly. thuyoides.*

C. TETRAGONUM Ag. a. *genuinum* Hauck. f.c. On *Rho. palmata* and *Saccorhiza polyschides.*—var. *brachiatum* J. Ag. (*Call. brachiatum* Harv.). W. 5, 6. On stipes of *Lam. Cloustoni.*

C. TETRICUM Ag. c. S. 3. W. 1, 5. E. 6, 8. Hanging from rocks.

C. CORYMBOSUM Lyngb. f.c. W. 1. E. 10.

C. GRANULATUM Ag. (*Call. spongiosum* Harv.). [E. 10. S. 2, 3, 5.] E. 6, 7, 8. N. 2. S. 4. W. 8. On rocks and *Ch. crispus.*

G. SEIROSPORA GRIFFITHSIANA Harv. On *Fucus* sp. Two very small specimens.

COMPSOTHAMNION THUYOIDES Schm. [E. 10.] N.W. 3. E. 6.

C.I. C. GRACILLIMUM Schm. v.r. E. 6.

PLUMARIA ELEGANS Schm. (*Ptilota sericea* Harv.). c. E. 5, 6, 8.

ANTITHAMNION PLUMULA Thur. N.W. 2. E. 11. Rock-pools.

G. A. CRISPUM Thur. In Le Jolis' Liste, p. 112 (*A. Plumula* var. *crispum* J. Ag., Batters Cat. p. 89). N.W. 4. N. 2. Rock-pools.

I have followed Mr. Cotton in giving specific rank to this plant, thus differing from Batters, who classified it as a variety of *A. Plumula.*

CROUANIA ATTENUATA J. Ag. f. S.W. N. 2. W. 1. On *Corallinæ*, etc.

CERAMIUM TENUISSIMUM J. Ag. (*C. nodosum* Harv.). [W. 5. N.W. 4.] W. 5. E. 2.—(G.) var. *arachnoideum* Ag. r. W. 1.

C. STRICTUM Harv. [N.W. 5.] S. 3. E. 6. N. 1. In crannies of rock.—(C.I.) var. *zostericola* Le Jol. W. 1. r.

G. C. FASTIGIATUM Harv. W. 5. S.W.

C. DIAPHANUM Roth. [N.W. 4, 5. E. 2.] S. 3, 2. W. 2. N.W. 4.

C. Deslongchampsii Chauv. [E. 2.]

c.i. C. circinatum J. Ag. (*C. decurrens* Harv.). S.W. W. 5, 8. E. 2, 3, 7.

C. botryocarpum Griff. [E. 2, 10. S. 4. N.W. 4.] N. 2.

C. rubrum Ag. c.

C. flabelligerum J. Ag. S. 4. One small specimen.

C. echinotum J. Ag. c. On *Codium tomentosum* and rocks.

C. ciliatum Ducluz. f. In muddy sand and on other algæ.

C. acanthonotum Carm. [N.W. 2.]

Microcladia glandulosa Grev. [S. 3. E. 11.]

Gloiosiphonia capillaris Carm. [N.W. 4.] N. 2. E. 6. N.W. 4. W. 8.

Grateloupia filicina Ag. [E. 2. S. 5.]—var. *intermedia* H. & B. [S. 3.] S. 4, 5. S.W. Shallow sandy pools.

c.i. G. dichotoma J. Ag. v.r. S.W. W. 2.

Only a single small specimen was collected in 1912; but in 1914 a prolific growth occurred in one locality which was moderately exposed, high boulders producing some slight shelter. Bushy tufts flourished in a series of narrow pools through which runnels of water streamed after the ebbing tide.

Dumontia incrassata Lam. (*Dumontia filiformis* Grev.). [S. 3. E. 10.] E. 2, 6, 10. N.W. 4.—(g.) var. *crispata*. E. 6.

Dudresnaya verticillata Le Jol. [W. 4.] N. 1. N.W. 2. r.

Dilsea edulis Stackh. (*Iridæa edulis* Harv.). [S. 3. E. 2, 10.] E. 6.

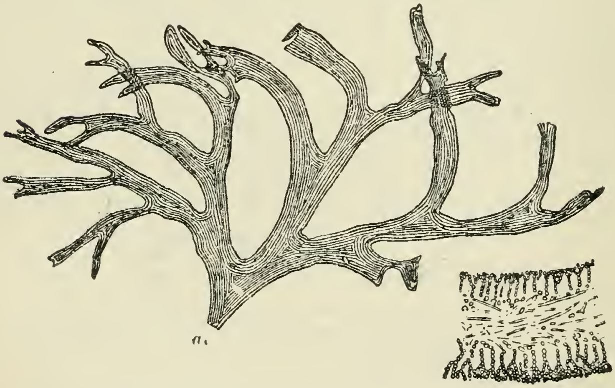

Fig. 6.—*Nemastoma dichotoma* J. Ag. *a*. Nat. size. *b*. Transverse section of thallus. × about 100.

Schizymenia Dubyi J. Ag. E. 6. N. 2.

Halarachnion ligulatum Kütz. [N. 2.] W. 1, 2. Very small specimens.

Furcellaria fastigiata Lamour. c.

b. Nemastoma dichotomum J. Ag. S. 5. One specimen growing on rock. (Fig. 6.)

This species, found growing in a rock-pool in a moderately exposed situation in September, is new to Britain. It is a native of the Mediterranean, whence it has travelled to the shores of Guernsey. The following description is taken from De Toni, p. 1662:—

Frond fleshy-gelatinous; stem round to compressed, loosely dichotomous, sub-fastigiate; segments patent, narrow linear, or cuneate, with obtuse ends mostly elongated.

Habitat: Ligurian Sea at Nice, the Tyrrhean Sea, coasts of Sardinia, Ionian Isles, Sicily, and Adriatic Sea.

Frond 4–10 cm. long, more or less regularly dichotomous, fastigiate; segments above the axils rounded, distinctly patent or sub-divaricate, below the axils linear, somewhat wedge-shaped, 2–5 mm. broad. The lower portion of the frond is generally narrower, the middle parts wider, the extremities again narrower. The terminal branches often 6–10 mm. long, linear attenuate but obtuse, sometimes short cuneate obtuse, sometimes sub-cornutely branched. Structure and fructification of the genus. Inner threads very dense, peripheral ones immersed in a small quantity of mucilage. Substance gelatinous-fleshy, thick and firm when dry, only slightly cartilaginous. Dried specimens adhere firmly to the paper. When fresh of a purple, almost wine colour.

Polyides rotundus Grev. [E. 1. S. 5.] W. 5. Shallow sandy pools and rocks.

Petrocelis cruenta J. Ag. [E. 10.] N. 1. E. 2. S.W.

Cruoriella Dubyi Schm. (*Peyssonnelia Dubyi* Crn.). [E. 2, 10. S. 5.] N. 2. E. 11.

Hildenbrandtia prototypus Nardo. c. Rocks and stones.

Schmitziella endophlœa Born. & Flah. On *Clad. pellucida.* [S. 2. N.W. 2.] N. 2. r.

G. Choreonema Thuretii Schm. N.W. 4. r.

Melobesia farinosa Lam. [On *Chy. kaliformis.* E. 6]; and on *Zostera* and *Clad. rupestris.* c.

M. Lejolisii Rosen. [On *Zostera.* N.W. 2. S. 2.]

Lithophyllum (Dermatolithon) pustulatum Fosl. (*Melobesia pustulata* Lam. and *M. verrucata* Lam.). [N.W. 2, 4. E. 10. S. 2.] W. 5. N.W. 5.—var. *Corallinæ* Fosl. (*Melobesia Corallinæ* Crn.). [S. 5.]—var. *Laminariæ* Fosl. (*M. Laminariæ* Crn.). [E. 2, 10.]

L. incrustans Phil. c. On rocks.

L. expansum Heydr. [E. 2, 10. N. 2. N.W. 2.] N.W. 4 On rocks.

L. lichenoides Phil. f. Lining rock-pools and on other algæ.

Lithothamnion polymorphum Aresch. (*Phymatolithon polymorphum* Fosl.). c. On rocks.

L. Lenormandi Fosl. c. On rocks, stones, and limpet-shells.

Epilithon membranaceum Heydr. (*Lith. membranaceum* Fosl. and *L. corticiforme* Fosl.). [E. 10. S. 5. N.W. 4 N. 2.] S. 5. E. 3, 6. W. 6. On other algæ.

Corallina officinalis L. c.

G. C. ELONGATA Johnst. (*C. mediterranea* Aresch.). W. 1. E. 6.
C. SQUAMATA Ellis. c. E. 9.
C.I. C. VIRGATA Zan. S.W. v.r.
C. RUBENS Ellis and Solan. (*Jania rubens* Lam.). f.c.—var. *corniculata* Hauck. (*J. corniculata* Lam.). [N.W. 4. S. 5. W. 4.] S.W. r.

III. Some Ecological Factors.

The methods of plant ecology have of recent years been applied to marine botany, and many new facts have been ascertained concerning the growth and distribution of Algæ. These subjects need still further investigation, though Harvey, Rattray, Murray, Darbyshire, etc., have furnished valuable contributions towards the knowledge of the subject.

One of the most recent workers in marine ecology is Mr. A. D. Cotton. His Report on the excessive growth of *Ulva latissima* in Belfast Lough (1911) and that on the Marine Algæ of Clare Island (1912) are standard works. The former deals very fully with the various conditions determining the presence etc. of Algæ, and clearly demonstrates the connection between a mud-formation and an Ulva-association. In the latter, Mr. Cotton has established the subject of marine ecology of Britain on a definite basis by subdividing the Algæ of a given district—that of Clare Island and the neighbouring shores—with regard to their habitat, degree of exposure, shelter, etc., into certain "formations" or types of vegetation and their concomitant "associations." For though foreign algologists, such as Kjelmann, Börgesen, Jonsson, and various others have dealt very fully with the subject of marine ecology, Mr. Cotton's are the first organised and comprehensive works of the kind produced in England. They therefore serve as a useful guide in subsequent studies of marine algal distribution in Britain.

(1) *Physical Position of the Island.*

The tidal stream flows up the English Channel in the direction E. by N., and falls W. by S.W. Guernsey is so situated that it stands right out in the southern portion of the stream and interrupts the normal flow of the body of water. Striking against the Channel Islands, the stream divides and flows on either side of them and also eddies round the Gulf of St. Malo. Spores, fragments, or plants of algoid nature carried as flotsam would stand a good chance of being intercepted by the obstructing rocks and islands, so that the prolific marine vegetation of the Channel Islands, including the presence of species not found on the British coasts, is largely owing to its geographical position.

(2) *Tides.*

Mean spring tides rise about 26 ft., with a corresponding fall. An enormous expanse of most varied character is exposed by the ebbing tide, thus affording a wide area for collecting; but the rapid rise and fall renders the ground somewhat dangerous—the collector, unless familiar with the shore, is apt to be cut off.

(3) *Currents.*

A note in *Nature* for Sept. 4, 1913, on the Oceanography of the Mediterranean—quoted from a Report of the Danish Expedition of 1908-10 to the Mediterranean and adjacent seas,—describes a "current of warm and highly saline water which flows eastwards . . . . and then northwards along the deep depressions of the sea-bottom, till it approaches the shores of Britain. It normally flows to the west of Ireland . . . . but if unusually strong, it may enter the shallower sea-basins. It has been suggested that it is owing to the presence of this highly saline Mediterranean water that the high salinities of the English Channel and the Irish Sea are due." The presence of this current would account for the appearance of many southern species, whose spores have been brought thither in its flow. *Padina Pavonia*, for example, is an inhabitant of the Mediterranean, but is well-established as a member of the British Flora; *Lithothamnion expansum, Corallina mediterranea, Nemastoma dichotomum, Colpomenia sinuosa* are among the more recent arrivals on our shores, and may have travelled hither by this means. The familiar Gulf Stream is also a carrier of spores and detached portions of seaweed, which are able to germinate and grow in the congenial warmth of the current which has brought them.

(4) *Nature of the Substratum.*

Apart from Plankton and other floating algæ, it is obvious that seaweeds require an anchorage or point of attachment; mud and sand are of too shifting a nature, and few species will be found growing on them. The abundant and varied marine flora of Guernsey indicates the peculiarly suitable and varied substratum which is afforded by the structure of the Island coasts. The following quotations, which will explain briefly the conformation of the island, are taken from Anstead's *Channel Islands* and from De la Mare's paper "On the Correlation and Relative Age of the Rocks of the Channel Islands," Trans. Guernsey Soc. Nat. Hist. Sci. ii. 1890-94:—

"The northern part of Guernsey consists of diorite sometimes approaching hornblende rock with syenitic and granitic veins." "These rocks are of a dark bluish-grey colour, remarkably fine grain, excessively hard, heavy and tough" (Anstead). "The southern part consists chiefly of gneiss, but diorite occurs in various parts . . . . . The diorite appears . . . . . to be associated with the gneiss in the form of inclusions rather than of intrusions . . . . . There is a considerable patch of fine-grained granite east of L'Ancresse." At Cobo the granite resembles some Jersey granite described thus—"generally of a pink colour due to the orthoclase felspar, which is abundant and contains both mica and hornblende . . . . . The mica traps are composed chiefly of mica and felspar" (De la Mare). The relative ages of these rocks De la Mare summarizes as follows:—"Some of the Guernsey granites, a large proportion of the dark blue diorite or diabase dykes, and perhaps some of the pink felsites . . . . . are Archæan (pre-Cambrian). The Cobo granite, the remainder of the diabase dykes, the quartz felsites and rhyolites . . . . . are comprised within the limits of the Cambrian system . . . . . The mica trap-dykes belong to the Carboniferous period . . . . . With the exception of some superficial pleistocene deposits no newer rocks are found." Anstead notes that "the rocks are remarkably broken and fissured by mineral veins, the enclosing rock and its veins being of different degrees of hardness, and the equal action of the sea on rocks of unequal hardness has produced those long lines of projecting rocky islets, the many narrow inlets, and the intersecting floors of rock between high and low water mark . . . . . An extreme complication of the vein system is beyond doubt the original cause of this peculiarity." A more ideal habitat for the growth of seaweeds than this coast with its wealth of boulders, nooks and crannies, overhanging rocks and basins, deep or shallow, it would be difficult to imagine.

Further information on the geology of the island is to be found in contributions by Collinette and Derrick in their presidential addresses, and by Dunlop "On the Superficial Deposits of Guernsey" (Trans. Guerns. Soc. Nat. Sci. iii. 1895–99). Accounts are given of the successive periods of submergence and elevation of the island during the Quaternary period: these changes of level were accompanied by processes of denudation and subsequent deposition of disintegrated matter; the latter, consisting of yellow clay or brick-earth, sand and rubble, etc., occurs in the interstices of the cliffs and on the lower levels of the island.

These superficial deposits are thus classified by Derrick in his article on Guernsey clays (*op. cit.* ii. 212):

"(1) Raised and ancient beaches; (2) Peat and the submerged forests; (3) The sand deposits of the north-western coast; (4) The land-slips from the cliffs on the south and east coasts; (5) The clays and loams; (6) The varied soil of the island."

The clays are of two kinds:

"Kaolin clay is not a superficial deposit in Guernsey . . . . . It is a direct produce of the disintegration of certain veins in granitic and gneissic rock, and is formed from the felspar which those rocks contain. On our beaches bands of clay, or broad veins filled with clay are rather numerous, the daily action of the tide hastening the process of decay, as at Longshore and St. Sampson's." This clay is used commercially under the name 'Butt clay.' "Clays forming true superficial deposits are widely distributed and nowhere covered by the rock or intersected by the veins, which rise toward the clay and turn off horizontally beneath it."

(5) *Configuration of the Coast.*

The Island of Guernsey is a right-angled triangle: the east coast forms one side, that of the south a second, while the third or hypothenuse consists of the west, north-west, and north coasts, merging imperceptibly into each other. The features of each side differ markedly.

The east coast is moderately sheltered and the climate mild. The Islands of Herm, Jethou, and Sark, and the coast of Normandy in the distance protect it from rough weather to a great extent. The largest opening on this side is Belgrave Bay. A roadway and wall skirt the upper part of the shore. Northwards are St. Sampson's Harbour and granite quarries; beyond is the deep and sheltered creek, Bordeaux. In the other direction are Fermain Bay and two or three inlets. Sand and pebbly beaches—with great upstanding boulders covered, or forming islets, at high tide,—reefs, platforms, and low-lying rocks, hollowed out into pools or chinks, comprise the main characteristics of the eastern side.

The south of the Island has two wide bays, within which are creeks running into the cliffs; this region is well sheltered and the temperature is warmer. Further along, the coast is difficult of access and moderately exposed, for the rocks rise sheer out of the water to a considerable height, but here and there are some narrow openings where the climb down to the boulder-beach, with rocky floors and pools, is steep and difficult. I was only able to examine one of these, Les Thielles. Pleinmont, the extreme south-west corner, is the most exposed part of the Island; the shores are rocky, very jagged and rough, and boulders of all sizes lie scattered about. The gigantic walls of rock screen off and afford some local shelter. Clefts between descending terraces give passage to runnels and streams, after the tide has receded. There are deep channels, pools, and lanes between the rocks.

The north-west coast is moderately exposed. Along it are five deep bays, sandy down the centre, but intersected with reefs, and rocky at the extremities. Large patches of *Zostera* occur low down on the beach. The northern arm of Rocquaine Bay is connected at low tide with the Island of Lihou by a causeway; on either side there is a vast area of sand and pebbles interspersed with rocks, pools, and *Zostera* beds. This is all covered at high tide and swept by a channel with a strong current. Here and there the rocks half encircle a terraced creek and give exceptional shelter. The whole coast from Pleinmont Point to Grandes Rocques is thickly fringed by countless islets, barriers, and reefs of rock, whose jagged and sharply-jutting crags break the huge waves which come rolling up the Channel into an enormous tract of surf and foam. The shores beyond and north of Grandes Rocques are much flatter and moderately exposed. There are several small bays with boulder-beaches. The rocks are less high and rough, the whole district lies at a much lower level than the south, the slope of land being from the south to the north downwards. Grande Havre and L'Ancresse are deep and land-locked bays; the former is a large quiet expanse with sandy beach and scattered masses of rocks. L'Ancresse is so hemmed round by rocks as to form a locally sheltered district with sharply-descending shores.

The coasts of Guernsey therefore possess aspects which range from extremely sheltered to quite exposed with the intermediates of moderately exposed or locally sheltered. The shores consist of sand, mud, and *Zostera* beds, with boulders and rocks of varying height and roughness.

(6) *Salinity.*

Owing partly to the smallness of the Island, there are only a few unimportant streams and an absence of any large body of fresh water discharging its contents into the sea. The general luxuriance of the marine vegetation is therefore unchecked by great variations in the degree of salinity, which, in the English Channel, is unusually high. Results of experiments made by Dickson between Bolt Head and Berry Head at depths varying from 30 to 17 fathoms show that 1 kilogram of sea-water contains 19·41 to 19·31 grammes of chlorine: "the water of the English Channel as far east as a line joining the Isle of Wight and Cherbourg is constant in composition at different seasons of the year." One may therefore safely conclude that these figures indicate fairly correctly the degree of salinity for the waters bathing the Channel Islands. It is not, however, so much the amount of salinity which affects the growth of seaweeds as changes in its degree which is harmful to them.

On the other hand, almost every creek has its little stream of fresh water running down it; certain species, such as *Grateloupia filicina*, are to be found in localities where the water is clear and flowing quickly. *Zostera* beds also flourish in the neighbourhood of fresh water among mud and sand; upon their leaves and stalks are found many epiphytic Algæ. Ulvas, Enteromorphas, and even Porphyras are unaffected by the presence of streams, and the two former abound in brackish pools where rain-water is conserved.

At Pulias, on the north-west coast, there is a large brackish pool; formerly *Cladophora flavescens* and *Cl. fracta* were to be found there. In 1911 and 1912, I found *Calothrix crustacea*, *Lyngbya semiplena*, *Chætomorpha linum*, *Pringsheimia scutata*, *Enteromorpha prolifera*, and *Gayella polyrhiza*, but in 1914 only *Chætomorpha linum*, *E. intestinalis*, and *E. compressa*, so that the nature of the pool seems to have changed.

Val du Braye is a neck of land between L'Ancresse and St. Sampson's which has been reclaimed from the sea; it contains a brackish pool where marine algæ have been said to exist. I was unable to obtain access to it.

Many of the fields lying along the shores of the west and north coasts are flooded in winter by the sea, and one would expect to find some salt-marsh forms of Algæ, but I never succeeded in doing so.

All available ground which is not built on or under cultivation is utilized for grazing purposes, and the soil becomes highly charged with manure, etc. This has perhaps gradually effected the extinction of marine algæ in the above pools and fields; it is certainly the case with the Pulias Pool. Marquand alludes to this as a possible explanation of the paucity of fresh-water algæ.

Along the upper limits of the shore, such as the bases of cliffs etc., the following fresh-water algæ are often found mingling with the habitants of brackish conditions:—

CHLOROPHYCEÆ. *Pleurococcus vulgaris* Meneg.; *Glœocystis rupestris* Rab. [on moist rocks at the foot of the cliffs, Petit Port]; *Porphyridium cruentum* Näg. on earthy cliffs at Pleinmont; *Vaucheria sessilis* Vauch. [Moulin Huet Valley].

PHYCOCHROMOPHYCEÆ. *Chroococcus turgidus* Näg. [M.]; *Glœocapsa granosa* Kütz.; *Microcystis* sp.; *Merispomedia glauca* Kütz. [M.]; *Nostoc commune* Vauch. [M.]; *Oscillaria tenerrima* Kütz. [at base of the cliffs]; *O. limosa* Libert [roadside ditch near St. Sampson's bridge]; *Rivularia granulifera* Carm. [at base of the cliffs, Petit Port].

(7) *Temperature.*

"The mean winter temperature of the atmosphere is 6 degrees higher than that of Greenwich, the summer temperature being rather cooler. The mean temperature is 2½ degrees higher than that of Greenwich" (Black). As the temperature of the Island has a range of 8 degrees, this comparative equability has a distinctly favourable effect on the growth of Algæ, especially those exposed for several hours by the falling tide. The average annual sunshine is 42 per cent., and the average sunshine per day is 5 hours; the average rainfall in the island is about 29·07 inches (Collinette).

According to Rattray, temperature has a distinct influence in hastening the production and emission of spores and prolonging the reproductive capability of Algæ. The maintenance of an even and mild climate must therefore assist in promoting the marine fertility of this island. Harvey noticed "how those small and delicate kinds which grow within tide-marks are found in greater luxuriance or in more abundant fruit in a warm than in a cold season." He also remarked "how *Padina Pavonia* attains in warm summers on the south coast of England a size as large as it does in sub-tropical latitudes, while in a cold season it is dwarfed and stunted." The summer of 1912 was exceptionally cold and wet, and the specimens were then plentiful, but small in size.

With regard to the temperature of the sea, Dickson has observed that "the upper layers of water from 3 to 5 fathoms are apparently subject to temporary local weather conditions which may or may not produce a distribution similar to that formed underneath." At a depth varying from 17 to 30 fathoms, this writer has reported the temperature to be 50·8 to 54 C.

IV. Arrangement.

(a) *Terminology.*

Owing to differences of opinion as to the exact definitions of the various terms employed in marine ecology, I have restricted myself to the use of such geographical expressions as "*Region*" and "*Zone*" or "*Belt.*"

"*Region,*" as used by Kjellman, is a term universally accepted to denote a portion of the shore with relation to the tide. He divided off the algal vegetation into three regions:—"1. The *Littoral region* stretches between the high-tide and the low-tide mark, and includes many Green algæ, Brown algæ, and some Red algæ. 2. The *Sub-littoral* ranges from below low-tide mark down to a depth of 20 fathoms (40 metres). Here algæ of all three colours are represented, but Green algæ cease, and Red algæ become more numerous with increased depth. 3. The *E-littoral region* is below the preceding and descends as deep as light; it is poorer in species and individuals—the latter are smaller and distorted. There is also a characteristic underlying vegetation of epiphytes requiring less light."

"*Zone*" or "*Belt*" indicates the lateral continuity of a genus or species along the shore. There is often over-lapping and intermingling of algæ in the respective zones; those of one zone may form undergrowths of others.

(b) *Types in relation to Habitat and Climate.*

The coast of Guernsey being mainly of a rocky nature, the marine vegetation is for the most part *saxicolous*, and the plants are either characterized by strong basal disks and attachments—e. g. *Fucus* spp., *Laminaria* spp., etc.—or form incrustations, such as *Ralfsia*, *Lithothamnion*, etc.

Here and there where disintegration of the rocks is complete, resulting in patches of sand along bays etc., the Flora is of a *psammophilous* nature. It includes various *Cyanophyceæ* whose gelatinous sheaths hold particles of sand together; "their threads permeate the sand to a depth of three millimetres" (Warming), *Catenella repens*, *Rhodochorton floridulum*, *Polysiphonia nigrescens*, *P. obscura*, etc., are also sand-dwellers; they hold the sand by means of filamentous rhizoids, thus forming tufts or pads which extend into compact masses. When disintegration is partial, exhibiting the intermediate stages of low rocks and pebbles, the character of the vegetation is *transitional*, pertaining partly to sand and partly to rock-floras, though possessing also distinctive characteristics. The plants are usually short, bushy, and much divided. The vegetation of shallow pools and channels also belongs to this category, which includes *Cladostephus*, *Mesogloia*, *Chondrus crispus*, etc. (Cotton).

Extreme conditions of disintegration have produced muddy patches often thickly beset with *Zostera*. This marine phanerogam by its horizontal roots acts as a capturer of the mud (Warming); upon its stems an abundant epiphytic growth occurs, including *Ceramium* spp., *Castagnea Zosteræ*, etc; these, together with such plants as *Laminaria saccharina*, *Chorda filum*, *Stypocaulon*, *Ectocarpus granulosus*, constitute the *vegetation of Zostera beds*. The series merge constantly into each other, following the varied nature of the coast-line.

Certain modifications in a Flora produced by differences in aspect, as described by Cotton, are clearly seen in Guernsey, where four distinct types of vegetation coincide in each case with certain climatic conditions. The dominant species are as follows:—

Type I. The exposed, on the S.W. coast:
Fucus vesiculosus var. *evesiculosus*, *Lichina pygmæa*, *Laminaria digitata*, *Corallina*, *Lithothamnion*.

Type II. The semi-exposed, on the W. and N.W. coasts:
Ascophyllum nodosum, *Rhodymenia palmata*, *Laminaria Cloustoni*.

Type III. The sheltered, on the S. and S.E. coasts:
Porphyra, *Enteromorpha intestinalis*, *Fucus vesiculosus*, *Rhodymenia palmata*, *Laminaria saccharina*.

Type IV. The moderately sheltered, on the N. and E. coasts:
Transitional flora with much intermingling of zones.—*Fucus serratus*, *Rhodymenia palmata*, *Himanthalia*, *Bifurcaria tuberculata*, *Laminaria digitata*.

I. *The Exposed Type.*

This type is well represented at Pleinmont, where the shore is rugged with a moderate slope, and the general appearance is desolate and bare. According to Rattray this bareness of rocks in an exposed position is "owing to the force of waves from deep water, whereby rhizoids or thalli are removed from the substratum, and the maturation of fruit is prevented. In such places there are fewer plants and of stunted growth." In view of this it is interesting to note in the chinks and fissures the occasional presence of certain matted species—e. g. *Polysiphonia macrocarpa*, *Ctenosiphonia hypnoides*—which hold sand, shells, etc., in their interstices and serve as a nidus for spores of other species, patches of *Lichina pygmæa* on the rocks and boulders also form whole nurseries for sporelings of *Fucus*, etc. *Laminaria digitata* occurs profusely, whilst beyond the limit of low tide, the erect snaky stipes of *L. Cloustoni* are seen standing up out of the water. There is very little *Pelvetia* or *F. spiralis.*

It was not possible to observe the extent of these growths owing to the difficulty of obtaining a boat. The inky patches of lichens, the dark tufts of *Fucus vesiculosus* var. *evesiculosus* along the mid-littoral, and the dull pads of *Cyanophyceæ* along the upper littoral, produce a sombre effect. Deep clefts and masses of rock afford considerable shelter, which brings about minor modifications of the general type.

II. *The Semi-exposed Type.*

The west and north-west coast of Guernsey, with its five bays, is distinctly exposed to the north-westerly winds and the force of Channel waves ; the bays are cut by reefs running at right angles to the shore, and they are further sheltered by a fringe of islets and sharp rocks which form a barrier shutting them in from the open sea ; these sheltering rocks profoundly modify the stormy nature of such a coast and give rise to conditions of semi-exposure.

Though not dominant, *Pelvetia* appears here and there in the upper areas in scattered tufts, increasing occasionally into large patches. *Fucus spiralis* also is well marked, but gives place lower down to *Ascophyllum nodosum.* The latter, according to Cotton, grows only in conditions of considerable shelter, but the opposite was found to be the case in Guernsey, where it prefers the semi-exposed and moderately sheltered habitats. It evidently thrives in the surf set up by the rocky conditions, and an enormous tract of this alga forms the great feature of the Semi-Exposed coast. *F. serratus* is infrequent, and is replaced in many instances by *F. vesiculosus. Himanthalia* is also scarce. Stretches of sand in this area form habitats for *Polysiphonia nigrescens*, *Ahnfeltia plicata*, *Cladostephus verticillatus*, *Gracilaria confervoides*, and *Chondria tenuissima.* *Zostera* beds with intervening groups of rock occur at low-water mark. Another dominant note is *Rhodymenia palmata* : heavy growths hang from rocks and boulders along the lower littoral, and take the place of *Ascophyllum nodosum* where there is less surf ; for instance, along Portelet, Rocquaine Bay, etc. The *Laminariæ* are represented mostly by *L. digitata* and *Saccorhiza polyschides* at low tide, but further from the shore towards the open sea they are replaced by *L. Cloustoni* (see p. 42).

III. *The Sheltered Type.*

In deep creeks and inlets in the south, Bordeaux in the east, and L'Ancresse in the north, this type of vegetation, as would be expected, is extremely luxuriant and diversified, and comprises many rare species. The *Chlorophyceæ* are much in evidence, as are also profuse growths of *Porphyra*, *Rhodymenia palmata*, *Chondrus crispus*, *Gigartina stellata*, *Gracilaria confervoides*, etc. Of the *Fuci*,—*F. spiralis* var. *platycarpus*, *F. vesiculosus*, and *F. serratus* are the most noticeable species; *Ascophyllum nodosum* is only represented by a few plants here and there. Along the sides of bays, low rocks, when half buried in the sand, as at Petit Port, are often covered with tufts or cushions of *Rhodochorton floridulum*, etc. Patches of soft encrusting algæ such as *Codium adhærens*, *Petrospongium Berkeleyi*, *Hildenbrandtia rubra*, and *Ralfsia* sp. are found scattered over boulders and stones; the rare *Gigartina pistillata*, *Crouania attenuata*, *Nitophyllum Hilliæ*, *Cladophora pellucida*, and *Helminthocladia purpurascens*, may be gathered at low tide, or from shady rock-pools. *Dudresnaya verticillata*, *Bonnemaisonia asparagoides*, etc., frequently drift from deep water into the quiet bays, together with long fronds of *Desmarestia ligulata*, *D. aculeata*, and *Halidrys siliquosa*. Enormous plants of *Ulva latissima* are also characteristic of these localities. *Laminaria saccharina* is the typical plant of that genus in sheltered districts, as Mr. Cotton observed at Clare Bay.

IV. *The Moderately Sheltered Type.*

The features of this type are very varied and constitute a mingling of saxicolous, psammophilous, and transitional floras, together with the vegetation of *Zostera* beds. *Pelvetia* is extremely local—here absent, there scanty, then forming an enormous expanse of many square yards, as at Port Grat, etc. *Porphyra* is mostly a spring growth and occurs just about high-water mark. *P. leucosticta* appears about the same time, but at half-tide level. Enteromorphas and Cladophoras are abundant, and so are the species of the "Fucus belt," *F. platycarpus* and *F. serratus* being those most in evidence. *Ascophyllum nodosum* is present, though only in patches here and there, but not so scanty as in the previous type. There is much intermingling of the brown algæ. A widespread growth of *Chondrus crispus* occurs among the shallow rocks and pools, and masses of *Rhodymenia palmata* hang from platforms and rocky ledges. The encrusting algæ—*Peyssonnelia* sp. and *Ralfsia* spp.—are very prominent from half tide down to low water on small stones, they alternate with sand-dwellers such as *Rhodochorton*, *Chondria dasyphylla*, *Cladostephus spongiosus* where there are patches of sand; while here and there *Zostera* beds with their various epiphytes occur.

Laurencia pinnatifida exists as an undergrowth from half down to low-tide level.

Along the sub-littoral, there is a mixed assembly of brown weeds: *Bifucaria tuberculata* forms large patches, or mingles with *Laminaria saccharina. Himanthalia lorea* occurs only in colonies here and there along the coast; its best development seems to be in moderately and even locally sheltered positions on rocks at about the limit of low tide. A group of rocks north of the White Rock bears an extensive crop of these plants; at Pleinmont, which is an exposed locality, it grows only in deep pools. The growth is so restricted that a zone of the genus can hardly be said to exist. Few plants were seen along the W. and N.W. coasts, and then only where locally sheltered.

(*c*) ZONATION.

The segregation of species into zones, and their arrangement at different levels along the shore with regard to the tide, is the result of various influences; among these may be mentioned the amount of insolation and desiccation that the respective species require or are able to withstand, and the periodic tidal exposures, rates of growth, etc. These have been indicated by Rattray and by Misses S. M. Baker and M. H. Bohling, who made extensive experiments and published valuable papers dealing with the causes of the zoning of *Fuci*.

Notwithstanding the mixed character of the Guernsey Marine Flora, the zones or belts are distinctly traceable. They vary considerably in width, become discontinuous and patchy, or even disappear for some distance where climate or substratum are unfavourable to their growth. The following notes deal with some of the most conspicuous zones and indicate in a small measure the interesting work awaiting a careful worker.

Beginning with the Upper Littoral and descending to low water, the various zones may be observed in the following sequence:—

	ALGÆ.		LICHENS.
			Verrucaria maura.
Upper Littoral Region.	*Pelvetia.* *Rivularia & Calothrix.* *Enteromorpha.* *Porphyra.*		*Lichina confinis.* *V. mucosa.*
Mid-Littoral Region.	*Fucus.* *F. spiralis.* *F. vesiculosus.* *Ascophyllum nodosum,* *F. serratus.* Encrusting algæ. Calcareous algæ. *Rhodymenia.* *Laurencia.* *Chondrus.*	or *Ascophyllum nodosum,* *F. vesiculosus.*	*Lichina pygmæa.*
Sub-Littoral Region.	Encrusting algæ. Calcareous algæ. *Laminaria.*		

Upper Littoral.

Verrucaria Zone.

Verrucaria maura grows over the dry, jagged rocks, giving them a mottled appearance and forming a well-marked band a short distance above the *Pelvetia* zone. This extends round the island independent of aspect, but is interrupted here and there by the encroachment of sea-wall or dykes, or the absence of suitable rocks. *V. mucosa* occurs in infrequent patches, often dry and exposed to sunshine for a considerable period of time; it extends from the limit of *V. maura* down to about half tide, where it forms dark green, almost black greasy stains among *Ascophyllum nodosum.* Both of these Verrucarias have been fully dealt with by Knowles and Cotton.

Pelvetia, which occupies the upper reaches of the littoral, is most sensitive to exposure, and its line is very varied in width. It is scantily developed in the exposed districts, growing only on rocks covered at high tide, and disappears altogether with extreme exposure. Where the projection of a reef screens a portion of the shore, the *Pelvetia* band immediately widens, to the extent of several yards, according to the slope of the shore. In summer the orange-coloured receptacles lend a distinct note to the surroundings. Along the north arm of Rocquaine Bay, Lihou Causeway, and L'Erée Bay, where the conditions are semi-exposed, there are great patches about 15 feet in depth. Again, with moderate shelter, and where the shore is very flat, the zone widens out enormously, as at Port Grat, and Grand Havre, a land-locked bay; but at no point is there much *Pelvetia* above high-water mark. In several localities of moderate shelter there is only a scanty growth on account of the steepness of the rocks; where a wall and roadway skirt the shore, the *Pelvetia* band disappears for long distances.

Rivularia and Calothrix Zone.

About high-water mark, but just below the *V. maura* belt, a line of *Rivularia* and of *Calothrix* occurs to a depth of 2 or 3 feet in dots and patches, and corresponds to the *Rivularia* and *Calothrix* association described by other workers. It consists of *Calothrix crustacea, C. scopulorum, C. confervicola, C. hydnoides, Lyngbya æstuarii, L. majuscula, Schizosiphon Warreniæ, Isactis plana.*

The zone is more apparent in exposed and semi-exposed regions; it decreases with moderate shelter, and with the exception of a wide scattering of *Rivularia bullata* almost vanishes from sheltered positions.

Enteromorpha Zone.

The Enteromorpha Zone is very broad and consists for the most part of *E. intestinalis.* It extends from the *Rivularia* and *Calothrix* line down through the other belts to low-water mark, often as an undergrowth. In exposed regions the development is poor, forming only a scanty growth on low rocks, or in pools. With shelter it becomes more noticeable and is mixed with *Cladophora rupestris, Chætomorpha* spp., etc. Great luxuriance is attained with increased shelter.

Porphyra Zone.

Thin, even patchy at places, and abnormally wide in others, the zone is more or less continuous round the island, sometimes the line is so narrow as to consist of single plants. The poorest development seems to be in exposed localities, where the plants are umbilical in form, short and tufted, and occur mostly as a scattered undergrowth among *F. spiralis* and *Enteromorpha* spp. With semi-exposure the zone increases in width and takes a lower range. The growth is generally very unequal, and frequently mingled with *F. vesiculosus.* On one side of Lihou Causeway it measured 2 feet; at Cobo, Albecq, and along the north arm of Rocquaine Bay there are large patches 13 feet across. Increased shelter produces larger plants of more continuous growth, as at L'Ancresse Bay, where there is a broad band of the species several feet wide along the mid-littoral. A remarkable case is seen at Petit Bot in extreme shelter: the principal feature is a prolific growth of *Porphyra* down one side of the Bay which mingles at first with *F. spiralis* and *Enteromorpha* spp., and descends through the zone of *F. vesiculosus* to low-water mark. The plants here are of considerable size, laciniate in form on low rocks, but umbilicate on boulders.

MID-LITTORAL.

The Fucus Zone.

Fucus spiralis is very sensitive to climate. In exposed localities it is found only in chinks of the rocks, more especially choosing those which run parallel to the shore, the band therefore is patchy and discontinuous. With semi-exposure *F. spiralis* begins among the *Pelvetia* and then forms a well-marked belt about 5 or 6 feet wide. Where the beach is pebbly and the rocks are low, *F. spiralis* grows over them, but if the shore is very rough and composed of sharp, high-standing rocks, with deep clefts, this species is absent. With a little local shelter, *F. spiralis* develops into the var. *platycarpus*, particularly on the sheltered sides of boulders; the fronds are often as much as six inches in length.

There is besides an abundant undergrowth of the following species:—*Ceramium rubrum*, *Spermothamnion Turneri*, *Cladophora rupestris*, *Rhodochorton Rothii*, *Catenella repens*, *Enteromorpha intestinalis*, *Ectocarpus littoralis*, *Hildenbrandtia prototypus*, sporelings of *Fucus* spp., *Ascophyllum nodosum*, and *Cladostephus* spp.

F. vesiculosus occurs about half tide on low rocks and stones: it appears either above or below *Ascophyllum nodosum*, according to the nature of the rocks (see p. 38). It may ascend up into the *F. spiralis* band, or descend and mingle with *F. serratus*. In moderately exposed districts, as at Cobo, *F. vesiculosus* sometimes takes the place of *F. serratus* and extends down to the limit of low tide; the line is then rather wide, ill-defined, and sparse. The greatest development is in sheltered situations. The epiphytes of this species are:—*Polysiphonia fastigiata* and *Pylaiella littoralis*. The following plants frequently occur as undergrowths:—*Rhodymenia palmata*, *Cladostephus* spp., *Chondrus crispus*, and *Lithothamnion Lenormandi*.

In conditions of extreme exposure, *F. vesiculosus* disappears altogether; it is superseded by the var. *evesiculosus*, a characteristic plant on exposed shores, which forms the continuation of the band of *F. vesiculosus* along such districts at about half tide. The fronds are short, stout, about 4 inches long, very dark, with strong basal disks and branches of equal length, as if cut with a knife. The plants often protrude from patches of *Lichina pygmæa*, or from holes and chinks of the rock, wherever a little shelter is to be found for the sporelings to start growth. *Polysiphonia fastigiata* is a frequent epiphyte.

Ascophyllum nodosum extends in varying profusion from Pezèrie Point to Grandes Rocques, where the climate is semi-exposed. A vast expanse round Lihou and the adjacent islets measures many square yards. As indicated by Cotton this plant largely depends upon suitability of substratum, for it can only grow on rocks of a height that enables the fronds to hang down; where rocks are flat or give place to sand, it disappears.

The relative positions of *Ascophyllum nodosum* and *Fucus vesiculosus* on the shore are interchangeable along the Guernsey shores; sometimes the one, sometimes the other, takes the higher range and succeeds *F. spiralis*. The determining factors, as already pointed out, are very possibly the size and height of the rocks at the respective levels; the two algæ frequently intermingle.

The hummocks and rocks round Lihou seem specially favourable for the growth of *Ascophyllum*. Its luxuriance there is also probably due in great measure to the prevalence of surf; where the extreme roughness of the coast creating this condition ceases, as beyond Grandes Rocques, it no longer figures as a conspicuous feature of the shore. Further along the band becomes much broken. Patches of varying size can be seen in moderately sheltered localities in the north at L'Ancresse Bay, and in the east at St. Peter's Port; but in extreme shelter only a few plants are to be found scattered here and there among *F. vesiculosus*, *e.g.* Petit Bot.

F. serratus occurs along the lower portion of the littoral and is always found covering low flat rocks; hence where these do not exist, a break in the continuity of the band results. The growth is very restricted and does not form a well-marked zone: it is favoured by shelter, but exposure is inimical. Often, where there is partial exposure, *F. vesiculosus* takes its place and extends in that case down to low-water mark; except as a pool-plant *F. serratus* is absent where conditions of extreme exposure prevail. *Spermothamnion Turneri* and *Elachistea fucicola* are frequent epiphytes.

The following species form undergrowths of both *F. serratus* and *Ascophyllum nodosum*:—*Cladophora rupestris*, *Hildenbrandtia* sp., *Lithothamnion Lenormandi*, *Gelidium crinale*, *Enteromorpha compressa*, etc.

Lichina Zone.

Lichina confinis grows over rocks here and there, and was specially noted at Rocquaine Bay below the Hotel Imperial. Miss Knowles describes this species as "semi-marine, and usually occurring along the inner fringe of high tide mark between the orange lichens and *Verrucaria maura*, and slightly overlapping these belts . . . . but it is occasionally coextensive with that of *V. maura*." It is found in the latter position along the shores of Guernsey in semi-exposed conditions.

L. pygmæa is conspicuous along the exposed districts of the Guernsey coasts. It grows in patches over the upper parts of rocks, more especially on stretches of boulder beaches where there are no algæ except in pools; this is contrary to the observations of Cotton, who points out the bad effect of extreme exposure on this species. According to Miss Knowles "*L. pygmæa* prefers rough surfaces and steep rocks which face the breeze and around which the sea breaks. Its range extends from the lowest limits of *V. maura* as far as low neap tide, and the growth is best developed in the upper part of its range among the Pelvetias and immediately below them." In the district round Pleinmont the maximum development was at about half-tide level. The growth of this lichen dwindles as shelter increases, though it can still be traced all along the coast. Wherever it occurs it affords a convenient site for the germination of sporelings of *F. spiralis*, *F. vesiculosus*, and several other species.

Zonation of Boulders.

It was interesting to observe how constantly tufts of *Ascophyllum nodosum* hung down from the lower parts of boulders in semi-exposed localities. Above them grew a few scattered plants of *F. spiralis* among the patches of *Lichina pygmæa*; further up appeared more *Lichina*, but the tops were bare. On the side of the rocks facing the sea there was less growth than on the landward side.

Rhodymenia Zone.

There is little or no *Rhodymenia palmata* in the south of the island; on the other coasts it frequently forms wide and extensive zones from below half-tide level down to the sub-littoral. Its luxuriance is for the most part unaffected by differences in climate, though changes of form accord with certain changes in climatic conditions. In the exposed district round Pleinmont, the plants of the littoral region are sparse, and nestle in chinks of the rock or hang from beneath over-arching boulders. They measure about 4 inches in length; the colour is dark red, and the stalks are stout and leathery with strong attachment disks. The prevalent form is wedge-shaped, with numerous stalked ovate proliferations along the edges. The plants of the sub-littoral are deeper in colour, thicker in texture, and considerably longer, increasing even to 2 feet in length. The form in this area varies from wedge to strap-shaped, with similar growths or proliferations superposed in stages upon each other, and apparently of greater significance than the leaflets of the var. *marginifera*. The undergrowths are *Chylocladia ovalis*, *Laurencia pinnatifida*, and *Hildenbrandtia* sp.

All along the west coast, where there is less exposure, the rocks at low tide are thickly covered with *R. palmata* var. *marginifera*. The plants are about 6 inches or so in length, reddish yellow in colour, much thinner in texture, and thickly fringed along their edged with long narrow processes. Occasional plants of *F. serratus* mingle here and there among the growth. With the moderately sheltered conditions of the east coast there is again a widely spread shaggy development over rocks of the same level, chiefly of f. *typica*, with fronds 4–6 inches in length. Here and there are specimens of vars. *sarniensis* and *marginifera*. Among the undergrowths are *Griffithsia setacea*, *G. corallina*, *Callithamnion tetricum*, and *Ptilota sericea*.

With increased shelter, as at Bordeaux and Petit Bot, etc., the same conspicuous and heavy growths are prevalent over the rocks at half-tide level, lower down the plants grow to enormous size, and are bright in colour and thin in texture. The epiphytes are *Phlœospora brachiata*, *Polysiphonia Brodiæi*, *Ectocarpus granulosus*.

Laurencia Zone.

L. pinnatifida occupies a similar position along the shore to that of *Rhodymenia*, but appears mostly as an undergrowth. Scanty, greenish procumbent patches creep over old *Lithothamnion Lenormandi* and *L. incrustans* at about half tide, where the perennial plants of *Laurencia* were seen sending up new shoots: their colour deepens towards the Sub-littoral and the growth increases in luxuriance. The best development was observed in moderate shelter.

Chondrus Zone.

C. crispus is fairly ubiquitous from the Mid-littoral down into the Sub-littoral regions. It is scanty in extreme exposure, but fairly abundant along the semi-exposed west coast, where masses of the deep water form are constantly thrown up: with greater shelter the zone is encroached on by other species—viz. *Gigartina stellata*, *Gracilaria confervoides*, *Cystoclonium purpureum*, *Laurencia dasyphylla*, etc. Of these, *Gigartina stellata* is the most abundant; it grows in patches here and there along the coast or inhabits rock-pools and flourishes best with moderate conditions of climate.

Zone of Soft Encrusting Algæ.

In sheltered districts *Hildenbrandtia* sp. grows over rocks and stones under the belt of *Fucus spiralis*, and descends occasionally to the lower littoral; at about half tide *Petrospongium Berkeleyi* and *Codium adhærens* form scattered patches over bare rocks down to low-tide level, as at L'Ancresse Bay and Saint's Bay. *Ralfsia* spp. and *Peyssonnelia* sp. are characteristic of greater exposure and have a wide range over the shore from above half tide down into the Sub-littoral, chiefly on small stones and limpet-shells under the shelter of the larger algæ. *Petrocelis cruenta* occurs very sparsely, irrespective of climatic conditions, at about the level of low-water mark.

Zone of Calcareous Algæ.

This Zone can be definitely traced round the island excepting where patches of sand or *Zostera* beds intervene. It is the widest of all the zones, spreading over the whole of the Littoral and Sub-littoral regions and extending beyond all other algæ to a considerable depth. Its maximum development is round Pleinmont in extreme exposure.

Corallina officinalis is at first short and tufted, increasing gradually in length as low-water mark is approached : it is replaced at low-tide level by *C. squamata*. *C. corniculata* and *C. mediterranea* appear with greater protection from storms.

Lithothamnion Lenormandi is always the uppermost of the calcareous encrusting species, appearing a little above the Mid-littoral. It prefers shady positions in chinks and crannies where some moisture is retained, and descends below half tide, mingling with and giving place to *L. incrustans*.

The delicate and beautiful *Lithophyllum lichenoides* forms a constant feature on the upper edges of rock-pools from half down to low-tide levels along the west, east, and north coasts. *L. incrustans* lines basins and pools up to the water's edge, then ceases abruptly, being unable to withstand desiccation. It occupies the lower Mid-littoral from about half tide to nearly low-water mark, and then mingles with *Lithothamnion polymorphum*. Where rocks have a smooth surface these Lithothamnions, by lining the pools and basins, create a roughness which affords a foothold for other algæ. *L. polymorphum* belongs exclusively to the Sub-littoral regions and beyond. It has a rounded knobby thallus.

SUB-LITTORAL REGION.

The various species of brown algæ connecting the Sub-littoral with the Littoral region, form a more or less continuous band along the shore, consisting chiefly of *Bifurcaria tuberculata* and *Cystoseira* spp. Where conditions of moderate shelter prevail, *Himanthalia lorea* mingles with the *Bifurcaria* or forms patches over the rocks and boulders at the same level; but with extreme exposure it disappears from the open and occurs only in locally sheltered pools. The condition of things therefore differs from that described by Cotton for Clare Island where he alludes to the plant as characteristic of moderately exposed shores. On the other hand, his statement that this alga is of a surf-loving habit in the British Isles is fully corroborated in Guernsey.

Zone of Calcareous Algæ.

The Zone of Calcareous Algæ is continued from the Littoral and extends far down into the Sub-littoral region, mostly as an undergrowth of other species. *Corallina squamata* and *Lithothamnion polymorphum* are most in evidence; they flourish best in fully exposed situations. With more moderate conditions, the following plants are often found creeping over the surface of *L. polymorphum*: *Gelidium crinale*, *Nitophyllum ramosum* f. *repens*, *Zonaria parvula*.

Laminaria Zone.

Owing to the impossibility of obtaining a boat except along the east coat, the study of the Laminarias was limited to observations at spring tides or of the weed thrown up on the shore. The enormous quantities of the latter heaped up in banks along the west coast, especially in autumn, lead one to conclude that there must be an extremely wide Zone of the genus in this district. Further round the island the débris decreases considerably, so possibly the Zone is narrower along the other shores. The influences of climate on a genus, resulting as pointed out by Cotton in changes of species according to changing conditions, are clearly illustrated by the Laminarias of Guernsey.

In the exposed type of flora, round Pleinmont, the *Laminaria* Zone consists in its upper portion of *L. digitata* and *Saccorhiza polyschides*, whilst extremely low tides reveal the presence of *L. Cloustoni*. Those plants nearest the shore are short, further out they increase to 3 or 4 ft. in length. The rough stipes of *L. Cloustoni* bear a plentiful crop of epiphytes, among which may be mentioned *Ectocarpus siliquosus*, *Rhodymenia palmata*, *Ptilothamnion pluma*, *Delesseria sinuosa*, *D. alata*, *Phyllophora palmettoides*, *Polysiphonia urceolata* var. *patens*, *Lomentaria articulata*. A plentiful growth of *Callithamnion tetragonum* occurs on the blades of *L. digitata*.

The epiphytes on the stipes of *Sacchorhiza polyschides* are *Ectocarpus Hincksiæ*, *E. arctus*, *E. Crouani*, *Myrionema reptans*, a thick felt of *Chantransia Lorrain-Smithiæ*.

Curiously enough some large and fine species of *L. saccharina* were seen in this district usually connected with shelter, they had possibly grown in deep fissures.

In the Flora of Type II., the Semi-exposed, along the west coast, there is first a small amount of *L. saccharina* mixed with *Chorda filum* and *Ulva latissima*; these are succeeded by *L. digitata* mixed with *Sacchorhiza polyschides*, whilst still further out *L. Cloustoni* becomes the dominant species. As shelter increases *L. saccharina*, the characteristic plant for protected areas, gains ground and finally displaces other species. It is almost the only *Laminaria* found in secluded creeks and quiet bays.

L. Cloustoni was not observed along the east and south coasts: it may have been overlooked. As the open sea is the more suitable habitat for this plant, viz. along the north and west coasts of Guernsey facing the English Channel, it is possible that the narrower and more confined waters between the Channel Islands and the French coast are less favourable to its growth.

(*d*) POOL VEGETATION.

Shore pools above high-water mark are more or less brackish, as they collect rain water and are rarely flushed by the sea. Most of them are shallow and fully exposed to the sun's rays, and therefore during summer become quite warm. They contain few algæ; *Enteromorpha intestinalis* is the most frequent. In pools lower down, within reach of the tide, *Cladophora* spp. and *Chætomorpha* spp. make their appearance.

Half-tide pools are sometimes shallow, with sand and pebbles. They contain such species as *Asperococcus fistulosus, Polysiphonia nigrescens, Cladophora rupestris,* and *Rhodomela subfusca.* Where the bottom is rocky, *Padina pavonia, Halopithys incurvus, Polysiphonia elongata,* etc. grow luxuriantly; whilst *Gelidium pulchellum, Griffithsia* spp., *Callophyllis laciniata, Laurencia* spp., *Lithothamnion Lenormandi,* etc. are to be found where there is sufficient shade.

Below half tide the vegetation of rocky pools becomes varied and abundant, including many sublittoral species. The edges of some pools are lined with the beautiful and brittle *Lithophyllum lichenoides,* below which there is a heavy growth of *Bifurcaria tuberculata* or *Cystoseira* spp. At the lower depth *Nitophyllum uncinatum* or *Calliblepharis lanceolata* send up hooked shoots which climb among the brown weeds. Other pools contain *Bryopsis plumosa, Codium tomentosum, Enteromorpha clathrata, Cladophora pellucida, C. distans, Dictyota dichotoma, Nitophyllum punctatum, N. ramosum, N. Hilliæ, Delesseria sanguinea, Chylocladia ovata,* etc.

Corallines and Lithothamnions line the bottoms of most of these pools with their pink and mauve incrustations: *Corallina officinalis, C. squamata, Lithophyllum incrustans, Lithothamnion polymorphus* are the most conspicuous species.

V. Composition of the Flora.

The mixed character of the Marine Flora which flourishes on the shores of Guernsey is doubtless owing to the geographical position of the island, which is so situated (see p. 26) that it lies well within the range of the Atlantic Flora. Guernsey is sufficiently near the shores of the English Channel and the west coast of France to participate also more or less in the type of vegetation fringing these littorals; this is composed very largely of a southern type of Flora, along with certain types of Atlantic and cosmopolitan marine vegetation.

NORTHERN ELEMENT.

There is in Guernsey a well-marked element which belongs to the vegetation of the North Atlantic, a Flora which extends to the Norwegian Polar Sea; many of the species, however, do not penetrate farther north than Scotland or the Faeröes. Owing to the influence of the Gulf Stream, which flows along the coasts of Norway and round Cape North, the temperature there is much higher than in other parts of the Polar Seas, so that the district characterised by Kjellman as the "Norwegian Polar Sea" is not purely Arctic; the Flora there is very closely allied to that of the North Atlantic, and is of varied composition with luxuriant littoral and tidal-pool vegetation. Brown algæ are dominant, though green algæ are abundant, with a fair number of red species. Southwards, this Flora ceases gradually along the Scotch and English coasts, the coasts of Spain forming the southernmost limit of many species.

Pylaiella littoralis var. *varia* has not been recorded further south than Scotland; it is a native of the Norwegian Polar Sea, and occurs also in the Arctic Seas. The presence of this plant in Guernsey is unaccountable: it may have travelled southward in a current that flows down the east coast of England, and, being caught in some of the cross-currents of the Channel, have drifted finally to Guernsey; or it may have been brought by some other agency, such as ships or even sea-gulls. *Alaria* is also a northern species belonging to the Faeröes. The Atlantic coast of France forms the southern limit of its distribution; it has been found in Guernsey and Alderney. According to Sauvageau, *Chorda filum* descends as far south as Gigon in Spain, but specimens have been found in the Mediterranean; the same writer also mentions the Corogne as the southern limit of *Acinetospora pusilla*. *Fucus serratus* is said by Harvey to extend as far as Spain: it does not occur in the Mediterranean; while Crouan has noted that *Tilopteris Mertensii* ceases to appear beyond the Spanish coasts.

The following are some northern elements of the Atlantic Ocean and the Norwegian Polar Sea which also exist in the Guernsey Flora: those marked with an asterisk occur also in the Arctic Seas:—

Bolbocoleon piliferum.
*Rhizoclonium riparium.**
*Cladophora glaucescens.**
*C. arcta.**
C. lanosa.
*Desmarestia viridis.**
*D. aculeata.**
*Dictyosiphon fœniculaceus.**
Lithosiphon Laminariæ.
*Punctaria plantaginea.**
Ectocarpus tomentosus.
E. Lebelii.
Pylaiella littoralis var. *varia.**
*Myriotrichia filiformis.**
*Elachistea fucicola.**
*Sphacelaria olivacea.**
*S. cirrhosa.**
Myrionema reptans.
*Cordaria flagelliformis.**
Castagnea virescens.
C. divaricata.
Leathesia difformis.
Chorda filum.
Laminaria saccharina.
L. digitata.
L. Cloustoni.
Alaria esculenta.
Fucus spiralis.
F. vesiculosus.
F. serratus.
Ascophyllum nodosum.
Pelvetia canaliculata.
Himanthalia lorea.
*Porphyra laciniata.**
Chantransia virgatula and var. *secundata.**
*C. Daviesii.**
Gigartina stellata.
Phyllophora membranifolia.
*Rhodymenia palmata.**
Phycodrys rubens.
*Delesseria sanguinea.**
D. alata.
D. angustissima.
Polysiphonia fibrillosa.
P. nigra.
Callithamnion polyspermum.
C. Hookeri.
Plumaria elegans.
Ceramium acanthonotum.
Polyides rotundus.
Petrocelis cruenta.
Epilithon membranaceum.

There is moreover in the Atlantic Flora an endemic Arctic element, which, according to Kjellman, originated in a glacial sea and passed from thence into the North Atlantic. The Arctic Algæ occurring in Guernsey are given below; they are also common to the English and French coasts, and three of them, marked with an asterisk, are cosmopolitan:—

Rhodochorton Rothii.
*Fucus vesiculosus.**
F. ceranoides.
Chorda filum.
Ralfsia deusta.
Elachistea fucicola.
*Scytosiphon lomentarius.**
Desmarestia viridis.
D. aculeata.
Dictyosiphon fœniculaceus.
Chætopteris plumosa.
Ectocarpus confervoides.
*Pylaiella littoralis.**
Enteromorpha compressa.
Rhizoclonium riparium.
Urospora penicilliformis.
Lithothamnion polymorphum.
Rhodymenia palmata.
Ahnfeltia plicata.
Ceramium rubrum.

The origin of this Arctic element is graphically described by Borgesen, from whom the following is taken:—"The European-American algal Flora of the North Atlantic has originated from a mixture of Atlantic and Arctic species. In tertiary times there was a land-connection reaching from Europe by means of the Faeröes and Iceland to America. . . . . . The Arctic Flora has gradually developed north of the land-connection; it is an old Flora, which has developed in the seas about the Pole, and has been very rich in endemic species. But when the land-connection was broken up, probably in the later tertiary period, a commingling of the species from the two formerly separated territories began and continued into the Glacial Period. During the latter, when the Polar Sea and the northern part of the Atlantic Ocean were covered by great masses of ice, the algal Flora was forced to go southwards, so that a Flora of Arctic character probably occurred as far down as the coasts of South England and North France. On its way south, however, this Arctic Flora met and became intermingled with the species of the Atlantic Flora, which had been able to resist the climatic changes. When the ice again receded after the Glacial Period, this algal flora, now composed of species from two different territories, again wandered towards the north, yet a few Arctic forms which were able to adapt themselves to a higher temperature remained on the coasts of England and France, while others withdrew to the Polar Sea proper."

SOUTHERN ELEMENT.

The southern element of the Guernsey Flora includes a very large number of Mediterranean species; some are even natives of the Indian Ocean, Brazil, West Indies, etc. There is a continual immigration northward of these southern species; many have long established habitats in the warmer parts of the Atlantic Ocean, whence they have travelled to the shores of Northern France, Guernsey, South of England, and even Scotland. The *Florideæ* dominate the southern type of Flora, though the *Phæophyceæ* and

Chlorophyceæ are fairly well represented. The following are some of these more southerly forms:—

Oscillatoria Corallinæ.
O. amphibia.
Isactis plana.
Phæophila dendroides.
Cladophora prolifera.
C. Hutchinsiæ and var. *distans.*
C. rectangularis.
C. repens.
Codium Bursa.
Phycolapathum crispatum.
Ectocarpus Vaillantii.
Myriactis pulvinata.
Halopteris filicina var. *sertularia.*
Mesogloia Leveillei.
M. lanosa.
Castagnea contorta.
Petrospongium Berkeleyi.
Zanardinia collaris.
Cutleria multifida.
Aglaozonia reptans.
Cystoseira ericoides.
C. granulata.
Taonia atomaria.
Padina Pavonia.
Dictyopteris membranacea.
Gelidium attenuatum.
Gymnogongrus patens.
Callymenia microphylla.
Halopithys incurvus.
Polysiphonia opaca.
P. obscura.
Ctenosiphonia hypnoides.
Spermothamnion irregulare.
Bornetia secundiflora.
Pleonosporium Borreri.
Callithamnion byssoides.
Antithamnion crispum.
Grateloupia filicina.
G. dichotoma.
Nemastoma dichotoma.
Lithophyllum expansum.

Besides these there is a considerable number of species having a wide range in the Mediterranean and the Atlantic.

The following species, though occurring here and there on the French and Spanish coasts, have not yet appeared farther north than Guernsey:—*Polysiphonia obscura,* native of Cadiz. Adriatic Sea; *P. opaca,* native of the Mediterranean; *Ctenosiphonia hypnoides,* native of Spain; *Nemastoma dichotoma,* native of the Mediterranean; *Lithothamnion expansum,* native of the Mediterranean. All these are purely southern forms, and may possibly be considered as aliens, but it is quite likely that their range will extend, and in the future, when fully established, they may come to be regarded as part of the British Flora.

The following is a comparison of the Guernsey Flora with neighbouring coasts, etc.:—

There are 350 species and 78 varieties and forms of Marine Algæ hitherto found in Guernsey, of which 382 species and varieties are common to the south of England and 333 to Ireland. There are also 43 species and varieties which do not occur on the southern shores of England; 32 of them are found in Ireland and North Britain, 10 being of a southern type, and one is a new species. The close connection of the Guernsey Flora with Ireland and the south of England is therefore evident. On the other hand, there is rather more of the Atlantic element in Guernsey than in the south of England, and in a certain number of cases the southern element differs slightly. Some species grow along the English coasts which are wanting in Guernsey; other species occur in Guernsey which have not yet been found along the southern shores of England.

As regards the Continent, Guernsey has 356 species and varieties in common with the north and west coasts of France, and 230 in common with North Spain; so that here again there is a great affinity, though in a lesser degree. The Flora of Guernsey corresponds more to the British than to the continental type of marine vegetation.

The species listed for Jersey number 317, with 54 varieties and forms; of these, 264 species and varieties are common to Guernsey. Guernsey has 161 species and varieties not yet recorded for Jersey, as against 81 Jersey species and varieties not recorded for Guernsey. Mr. Lester Garland attributes the differences in the terrestrial Floras of the two islands to the variations of level owing to their complete or partial submergence at different periods, leading to the destruction of certain species. Inversely, it is possible that periods of elevation of varying degree to which the islands have also been subjected in past ages, may have caused the disappearance of many Marine Algæ.

The ecological factors that prevail in Guernsey are often different in Jersey: thus Jersey lies farther to the south and is less open to the influence of the Channel Stream bringing various new elements in its wake; the shores are more protected by the coasts of France, and the climate is warmer than that of Guernsey; the configuration of the coast is different, being characterized by wide sandy bays on the south, west, and east, the shores having a very gradual incline, while on the north there are high standing cliffs. These are only a few of the physical conditions that would tend to control the character of the Floras of Jersey and cause it to differ from that of Guernsey.

VI. Economics.

The inhabitants of Guernsey utilise the abundant harvests of marine vegetation to a considerable and praiseworthy extent. At stated seasons of the year the *vraic* (Fuci, etc.) is cut, and enormous masses of weed, thrown up especially on the west coast, are gathered from the shores, to the extent, according to Black, of at least 30,000 tons annually. While these activities are in progress, as many as twenty or thirty carts can be seen on the beach, whence they bring a varied assortment of species. Both drift and cut weed are spread on the adjacent land to dry; some is used for fuel, the rest burnt for kelp or employed as manure.

Kelp.—There is much indiscriminate burning of weed for kelp by the cottagers, who sell it for about 1*s.* per bushel. It varies in quality according to the species burnt. Sharp practice occurs among the less honest of the burners, who only partially burn the weed and even mix it with sand to increase the bulk.

The late Mr. Best of Guernsey established factories for preparing potash and iodine, which found a ready sale on the island: he told me that drying-frames had been erected on the island of Lihou in stacks one above another with intervals of about 18 inches between each; the weed was placed on the frames or racks and dried in the open. There was also a drying machine heated by the burning weed, and kelp was thus produced at the same time. The work met with such success that in 1916, 18 tons of 90 °/₀ muriate of potash, and over 18 tons of chloride of sodium containing 15 °/₀ of sulphate of potash were obtained from seaweed. Mr. Best's success in extracting potash with the methods at his disposal, justify one in raising the question whether the vast quantities of weed that are allowed to rot on our coasts might not be utilized to some profit. He was of the opinion that this might be done if the problem of labour could be solved.

Manure.—The farmers plough the weed into the ground and use it in a general way. There is an old Guernsey saying: "No seaweed no cornyard." The advantages of using seaweed as manure are detailed in a pamphlet published by the Board of Agriculture and revised up to 1913. It contains much valuable information as to chemical constituents, etc.

Fodder.—Although it is known that the sheep on L'Ancresse common stray over the shores and browse with gusto on the Fuci, nothing is done on the island by way of utilizing seaweed as fodder. *Fucus vesiculosus* might well be used for this purpose in winter, while *Chondrus crispus* is valuable in fattening calves and pigs. Incidentally, it is interesting to note that successful experiments have recently been made with Laminarias as forage for horses instead of oats. The algæ were prepared and given to the animals, who accepted, digested, and assimilated the novel food.

Food for Man.—Considerable attention has been directed towards the use of seaweeds as food for man, more especially during the late War. According to Alsberg there is no proof that seaweeds have more than a moderate food-value, though they have a considerable value as antiscorbutics like cabbage and lettuce. Almost nothing is known about the proteids of seaweeds; but according to Cameron they have not anything like the food value of cereals. The value of seaweeds as a food is to a large extent due to the mucilage produced by the membranes of the cellular tissue, which is rich in pectics and hemicelluloses; it dissolves readily in boiling water and forms a jelly when cold. On account of this property the attention of experts is being directed towards the utilization of seaweeds both in cookery and in various commercial preparations.

Very little, however, is known about the chemical composition of these membranes. Among the green seaweeds the cellulose is associated with hemicellulose, a substance soluble in 3 °/₀ sulphuric acid and containing a great abundance of xylane; there is also an insoluble portion rich in dextrane. Another hydrocarbon which has been detected in *Fucus* is called "fucine"; it is soluble in 1°/₀ sulphuric acid, and turns blue with iodine; it is localized in the middle lamella. Again, dextrose, and methylfurfurol occur in the brown algæ. The red seaweeds, according to Perrot & Gatin, contain galactans, mannans, lævulosans, dextrans, and sometimes methylpentosans. Some of these complex carbohydrates are a possible source of energy, but how far is not known. Fat is a negligible quantity.

As regards the general constituents of seaweeds, the analyses below indicate to some extent how far one is justified in considering the value of seaweeds as food.

ANALYSES BY TURRENTINE (Cameron).

Gelidium corneum.

Water	22·29
Protein	6·85
Carbohydrates	60·32
Ash	3·81
Fibre	6·73

Laminaria spp.

Water	22·82–24·44
Protein	5·49– 5·82
Fat	1·52– ·74
Soluble non-nitrogenous material	47·83–45·57
Fibre	4·55– 6·44
Ash	18·69–17·00

Of other substances found in seaweed, bromine occurs more abundantly in *Fucus serratus*; *Laminaria digitata*, *L. saccharina*, and *F. vesiculosus* are richest in iodine, *Saccorhiza bulbosa* containing somewhat less. It is not yet known whether this element is contained in the form of alkaline salts or in organic combinations.

Perrot and Gatin state that minute quantities of arsenic have been found in marine algæ: it is possible that the tonic properties with which food or medicine prepared from seaweed is credited are owing in some measure to the presence of this substance.

The incrustations of calcareous algæ when produced in large quantities have a manurial value. Along the west coast of Ireland there are beaches composed of broken fragments of Lithothamnions, cartloads of which are conveyed inland for the sake of the carbonate of lime as a soil-dressing (Cotton). In Guernsey it would be quite possible to collect appreciable amounts of the calcareous algæ for agricultural purposes.

For suggestions of what might be done with our seaweeds, I have had recourse to Cameron's Report on the Fertilizer Resources of the U.S. of America, 1911, from which the following particulars have been extracted:—

Formerly the Americans imported the whole of their potash for agriculture and other purposes; they are now working up the resources of their own country, mineral and marine. A yield of $16,000,000 worth of potash has already been obtained from seaweed, and by organization of the industry and regulation of the harvests and preparation of the weeds, it is proposed to build up a recognized source of wealth and industry for that nation. Recent experiments have discounted the methods of drying and burning, whereby many valuable constituents of the seaweed are lost or destroyed; and the burning of seaweed for the sole purpose of obtaining *iodine* has been compared to the wastefulness of using mahogany for firewood, or "burning down a cottage to boil a kettle." By the newer methods, all the soluble salts and a maximum amount of iodine can be extracted from seaweed. In addition, the production of certain residuals and by-products, as a result of these methods, seems to possess such a possible future value in textile and other industries as to warrant a return to the utilization of seaweed for the production of iodine. Thus, when seaweed is submitted to the process of partial burning and distillation in closed retorts, a porous and valuable charcoal results, from which all the soluble salts, including the iodides, can be dissolved out with readiness, leaving such residuals as ammonia, tar, and paraffin oil. This marine charcoal might serve as a fuel under the retorts or pans used for the purposes of distillation. Its extreme porosity makes it an effective deodorant and decolorizer and a valuable filter, for it has been subjected to the thickest town-sewage for several months without the least clogging, and its efficiency after this treatment remained unimpaired. As a substitute for bone-black, it is most highly recommended. The oily tar produced by the distillation of seaweed mentioned above, yields, on redistillation, large quantities of paraffin oil. As much as 617 galls. of oil can be obtained from one ton of Fucus.

In another method, devised by Stanford, the seaweed was submitted to repeated direct lixiviations or macerations in dilute solutions of carbonate of soda or other alkaline substances. After obtaining the requisite salts and iodine, the residuals were algin, cellulose, and dextrin.

Algin, when treated with sulphuric acid and other chemical processes, becomes a hard horn-like substance, having properties that enables it to be used as a substitute for india-rubber and parchment.

Sodium alginate, a derivative of algin, is a gum possessing 14 times the viscosity of starch, and 37 times that of gum arabic; it is distinguished from albumen in not coagulating by heat. It could be put to varied uses such as a mordant in dyeing and in sizing cloth; in cookery it might be used in thickening soups, puddings, and jellies. In pharmacy it would be useful as an excipient for pills, an emulsifier of oils, and for softening water. Mixed as a binding with charcoal, sodium alginate might serve as a coating for boilers and metal work; combined with shellac it forms a fine varnish, and owing to its resemblance to gutta percha it is said to be a good insulator. Cellulose, if combined with other materials which furnish the requisite amount of fibre, can be made into paper of an excellent grade.

Knife-handles are made by cutting lengths of *Laminaria Cloustoni* stipes and forcing blades into them. When dry the latter remain firmly fixed, and owing to the irregular shrinkage of the portions they assume a roughness similar to staghorn. Such handles are used in Scotland and in various parts of S. America. Imitation citron, orange and lemon-peel are made at Seattle from the bulbs and hollow parts of the stipes of *Nereocystis Luetkeana*, one of the large

Laminariæ. After the salts have been extracted the portions are boiled in flavoured syrup. "Seatron" is the name given to these preparations.

According to a writer in *Chambers's Journal* for 1917 (p. 555), seaweed is one of the many sources for obtaining *acetone*, a chemical used in the manufacture of *cordite.* Large quantities are obtained and used for that purpose in America.

Culture.—In view of the careful culture of seaweeds in Japan, as narrated by Yendo, and their productiveness as a source of revenue, it seems worth while to give the matter some attention. There is no necessity to sow the spores: a suitable substratum alone is requisite. In Scotland and Ireland where Fucus farms exist, stones are set down on flat sandy or muddy fore-shores on which abundant growths of vegetation soon appear. The rocky shores of Guernsey hardly require such preparation. Should, however, the seaweed industries of the Island increase, and necessitate further supplies of the weed, its growth might be augmented by putting down boulders and stones of suitable size, where there is a sandy bottom. The vast tracts in Grande Havre, on either side of Lihou causeway, and along the Vale coast, etc., could be treated in this way.

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THE FLAGELLATES AND ALGÆ OF THE DISTRICT AROUND BIRMINGHAM.

(Compiled from records left by the late Professor G. S. West, M.A., D.Sc.)

By W. B. Grove, M.A., B. Muriel Bristol, D.Sc., and Nellie Carter, D.Sc.

◆

Introductory Note.

The following lists of Flagellates and Algæ found in the district around Birmingham are compiled and arranged almost entirely from the records made by Professor G. S. West during the last thirteen years of his life (1906–1919). Besides the large amount of material which he collected himself, it was his custom to look carefully through the numerous collections brought from various localities by the undersigned, and by his students and others, making a list of all the different species he saw. These lists were kept by him with a view to publication at a future date. His lamented death leaves them very incomplete, and without the benefit of his final revision and the notes which he would have added from his unrivalled knowledge; yet it is thought that it would be well to publish them, since the determinations are particularly valuable as being those of one who was the foremost British expert on the Freshwater Algæ.

The large number of records from Sutton Park is the result of the special attention devoted by Professor West to that area, which owing to its extensive moorland tracts and submontane character is very different from most other parts of the district. Here, during the years 1906–1909, he collected material in every month of the year, including monthly samples of the plankton of the pools. It was his intention to use these records as the basis of an ecological account of the Algæ of that area, but no attempt seems to have been made at beginning this work, except his account of the "Peridinieæ of Sutton Park," which was published in the *New Phytologist*, 1909, pp. 181–196.

In the records from the Park reference is frequently made to three bogs; of these Bog I is the large boggy area above Longmoor Pool, Bog II is the similar ground situated on the south-west side of Little (Upper) Bracebridge Pool, and Bog III is that above the upper end of Blackroot Pool.

All the species contained in the following lists, by whomsoever collected, where the locality is not followed by the finder's name, were seen and named or confirmed by Professor West; those collected by any whose names are appended may be taken as having his approval, except those which have been discovered since his death; these latter have been identified by Mr. W. J. Hodgetts, M.Sc., and have the locality enclosed in square brackets and followed by his initials.

The localities have been arranged under three heads:—wk. = Warwickshire, ws. = Worcestershire, st. = Staffordshire. The actual months in which the various species were collected are indicated, after the name of the species, by the Arabic numerals 1–12.

Thanks for liberal assistance in defraying the costs of this publication, as a memorial of the esteem in which Professor West was held, are due to the University of Birmingham and to the Research Fund of the Birmingham Natural History and Philosophical Society.

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FLAGELLATA.

MALLOMONAS Perty.

M. acaroides Perty. 10.
WK. In the plankton, Bracebridge Pool, Sutton Park.
M. longiseta Lemm.
WK. In the plankton, Bracebridge Pool, Sutton Park.

SYNURA Ehrenb.

S. Uvella Ehrenb. 1–7, 9–12.
WK. In Bogs I, II, and III, and in the plankton, Bracebridge Pool, Sutton Park; Berkswell; Yardley. WS. Pond near Hawkesley Hall, King's Norton; Wyre Forest.

UROGLENA Ehrenb.

U. Volvox Ehrenb. 7–10.
WK. In the plankton, Bracebridge Pool; Olton Reservoir.

CYCLONEXIS Stokes.

C. annularis Stokes.
WK. Lapworth. This curious organism, whose colony takes the shape of a ring or bracelet, has been recorded before only once from North America and once from Germany. The same species was, however, probably found by T. Bolton in Sutton Park; see Midland Nat. 1886, ix. 175.

DINOBRYON Ehrenb.

D. Sertularia Ehr. 7.
WK. Bog III, Sutton Park.
D. protuberans Lemm. 7, 10.
WK. Bog III, Sutton Park.
D. sociale Ehr. var. *elongatum* (Imhof) Lemm. 5.
WK. In the plankton, Bracebridge Pool, Sutton Park.
D. cylindricum Imhof. 2–7, 12.
WK. In the plankton, and Bogs I and III, Sutton Park.

CRYPTOMONAS Ehrenb.

C. ovata Ehr. 6 etc.
WS. [King's Norton, *W. J. H.*]
C. Nordstedtii (Hansg.) Senn. 6.
(=*Chroomonas Nordstedtii* Hansg.)
WS. [Harborne, *W. J. H.*]

EUGLENA Ehrenb.

E. viridis Ehr. 3–5, 10.
Common, and generally distributed.
E. intermedia (Klebs) Schmitz. 4.
ST. [Bearwood, *W. J. H.*]
E. sanguinea Ehr. 5–7.
WS. King's Norton.
E. acus Ehr. 5, 6, 12.
WK. Sutton Park. WS. King's Norton, *W. J. H.*
E. oxyuris Schmard. 6.
WK. Harborne and Sutton Park, *W. J. H.*; Pond at Berkswell.
E. tripteris (Duj.) Klebs. 5.
ST. [Bearwood, *W. J. H.*]
E. spirogyra Ehr. 4, 5, 8, 10.
WK. Sutton Park; Henley-in-Arden; Berkswell. WS. King's Norton, *W. J. H.*
E. deses Ehr. 8–10.
WK. Common. Sutton Park; Berkswell, etc. WS. Stapenhall Farm, King's Norton. Movement very sluggish.

LEPOCINCLIS Perty.

L. ovum (Ehr.) Lemm. 5.
WS. [King's Norton, *W. J. H.*]

PHACUS Dujardin.

P. anacœlus Stokes. 10, 11.
WK. Earlswood.
P. longicauda (Ehr.) Duj. 5–7, 9.
WK. Harborne; Henley-in-Arden. WS. King's Norton; Canal, Lifford.
P. pleuronectes (O. F. M.) Duj. 3–7, 9, 10.
WK. Sutton Park; Berkswell. WS. King's Norton; Canal, Lifford; Warstock.
P. pyrum (Ehr.) Stein. 10, 11.
WK. Earlswood. WS. King's Norton.
P. parvula Klebs. 4.
WS. [Hawkesley Hall Farm, King's Norton, *W. J. H.*]

TRACHELOMONAS Ehrenb.

T. volvocina Ehr. 1, 6, 7, 10, 11.
WK. Earlswood; Bradnock's Marsh, etc. WS. King's Norton.
T. oblonga Lemm. 6, 7.
WS. [King's Norton, *W. J. H.*]
T. inconstans Carter. 1, 5, 7–9, 12.
WK. Sutton Park. See New Phytol. 1919, xviii. 118.
T. hispida (Perty) Stein. 5–7, 9–11.
WK. Sutton Park; Earlswood; Bradnock's Marsh, etc. WS. King's Norton; Warstock. ST. Pool House Farm.
T. rugulosa Stein. 4.
ST. [Bearwood, *W. J. H.*]

COLACIUM Ehrenb.

C. arbuscula Stein.
Found attached to the free-swimming Rotifers *Anuræa* and *Notholca*.

EUTREPTIA Perty.

E. viridis Perty. 6.
ST. [Bearwood, *W. J. H.*]

VACUOLARIA Cienk.

V. virescens Cienk. 8.
WS. [Hunnington, *W. J. H.*]

MYXOPHYCEÆ.

GLŒOCHÆTE Lagerh.

G. Wittrockiana Lag. 10.
WK. Bracebridge Pool, Sutton Park.

SYNECHOCOCCUS Näg.

S. æruginosus Näg. 10.
WK. Sutton Park; Studley.
S. major Schröt. 4.
WK. Sutton Park.

APHANOTHECE Näg.

A. saxicola Näg. 2, 6, 11.
WK. Plankton of Bracebridge Pool, Sutton Park.
A. microscopica Näg. 7, 11.
WK. Plankton of Bracebridge and Longmoor Pools, Sutton Park.
A. stagnina (Spreng.) A. Br. 6.
WK. Bracebridge Pool, Sutton Park.
A. prasina West (= *A. stagnina* var. *prasina* A. Br.). 4–6.
WK. Bracebridge Pool, Sutton Park; Shirley. ST. Quarry House, Hamstead.

DACTYLOCOCCOPSIS Hansg.

D. montana W. & G. S. West. 4.
WK. [Sutton Coldfield, *W. J. H.*]

CHROOCOCCUS Näg.

C. turgidus (Kütz.) Näg. 1, 3, 6, 8, 10, 11.
WK. Plankton of Bracebridge Pool, Sutton Park; Olton; Windmill Pool, Shirley. WS. Hartlebury Common; Trimpley. ST. Great Barr Park.
C. minutus (Kütz.) Näg. 3, 5, 8–10.
WK. Sutton Park, Bogs I and II.
C. minor (Kütz.) Näg. 6.
WK. Sutton Park, Bog III.
C. helveticus Näg. 7, 10–12.
WK. Bracebridge Pool, Sutton Park.
C. macrococcus (Kütz.) Rabenh. 3.
WS. Hartlebury Common.

C. pallidus Näg. 6.

WK. Sutton Park. Bog III.

C. limneticus Lemm. 1–12.

WK. Plankton of Bracebridge, Blackroot, Windley and Powell's Pools, Sutton Park. WS. Stourport.

MICROCYSTIS Kütz.

M. elabens (Menegh.) Kütz. 5.

WK. Lapworth.

M. ichthyoblabe Kütz. 6, 7.

WK. Sutton Park.

M. marginata (Menegh.) Kütz. 5, 6.

WK. Olton; Lapworth.

M. æruginosa Kütz. (=*Clathrocystis æruginosa* Henfr.). 3–12.

WK. Plankton of Sutton Park; Yardley Wood; Studley; Arley. WS. Stourport; Kidderminster.

M. incerta Lemm. 4–6, 10, 11.

WK. Plankton of Windley and other pools, Sutton Park.

M. pulverea (Wood) De Toni. 1, 4–6, 9–12.

WK. Plankton of Bracebridge Pool, Sutton Park; Olton; Shirley. ST. Great Barr Park.

M. holsatica Lemm. 1–7, 9–12.

WK. Plankton of Bracebridge Pool, Sutton Park.

M. ochracea (Brand) Forti. 8.

WS. Kidderminster and Stourport (see Griffiths, in Linn. Soc. Journ.. Bot. 1916, xliii. 429). New to Britain. What is probably the same species was found in the plankton, Sutton Park, but was not definitely named. See also West, Journ. Bot. 1912, p. 79.

Clathrocystis roseo-persicina Cohn=*Lamprocystis r.-p.* Schröt., which has often been described as an Alga, is now considered to be a Schizomycete and called *Cohnia roseo-persicina* Wint. It is not uncommon in stagnant ponds.

ASTEROCYSTIS Gobi.

A. halophila (Hansg.) Forti. 11.

WK. Studley, on the older filaments of *Cladophora crispata*. See West, Journ. Bot. 1912, p. 331. First record for Britain.

GOMPHOSPHÆRIA Kütz.

G. aponina Kütz. 7, 8, 10.

WK. Plankton, Bracebridge Pool, Sutton Park. WS. Kidderminster; Stourport. ST. Himley Park.

G. lacustris Chod. 2, 5–11.

WK. Plankton, Bracebridge, Blackroot and Powell's Pools, Sutton Park; Olton; Studley; Shirley. WS. Canal, Lifford; Stapenhall Farm, King's Norton. ST. Himley Park.

CŒLOSPHÆRIUM Näg.

C. minutissimum Lemm. 8.

WK. Plankton of Windley Pool, Sutton Park.

C. Kützingianum Näg. 6, 9, 10.

WK. Plankton of Bracebridge Pool, Sutton Park.

C. Nägelianum Ung. 8.

WS. Stourport.

MERISMOPEDIA.

M. glauca (Ehr.) Näg. 5–10.

WK. Plankton, Bracebridge Pool, and ditch, Sutton Park; Hampton-in-Arden; Lapworth; Olton; Studley. WS. King's Norton, Kidderminster; Stourport.

M. elegans, A. Br. 6, 10, 11.

WK. Plankton, Bracebridge Pool, Sutton Park. WS. King's Norton.

M. æruginea Bréb. 5, 10.

WK. Plankton and Bog II, Sutton Park; Lapworth.

Var. *violacea* Rabenh. 10.

WK. Studley.

CHAMÆSIPHON A. Br. & Grun.

C. incrustans Grun. 10.

WK. Studley, on *Cladophora crispata*. WS. Quinton, on *Rhizoclonium*.

C. confervicola A. Br. 4–6, 10.

WK. Coleshill; Studley. WS. Warley; Hagley, on *Chætomorpha*; Barnt Green. ST. Himley Park.

OSCILLATORIA Vauch.

O. limosa Ag. 2–11.

Very common and generally distributed.

O. princeps Vauch. 8.

WK. Bog II, Sutton Park.

O. tenuis Ag. 3–6, 10, 11.

WK. Plankton of Windley Pool and Bog II, Sutton Park; Coleshill; Berkswell. WS. King's Norton; Cofton Reservoir. ST. Quarry House, Hamstead.

O. irrigua Kütz. 3, 5, 6, 10, 12.

WK. Plankton of Bracebridge Pool, Sutton Park; Olton Reservoir, etc. WS. Hawkesley Hall Farm, King's Norton. ST. Great Barr Park.

O. simplicissima Gom. 6.

WK. Hampton-in-Arden.

O. amphibia Ag. 5, 10, 12.

WK. Shirley; Studley. WS. Barnt Green; Trimpley. ST. Great Barr Park.

O. splendida Grev. 8, 10, 11.

WK. Bracebridge Pool, Sutton Park; Shirley. WS. King's Norton (*O. leptotricha* Kütz.), in the pool near Hawkesley Hall.

O. formosa Bory. 2.

WK. Exact locality left doubtful.

O. decolorata G. S. West.

WS. Wyre Forest (saprophytic).

PHORMIDIUM Kütz.

P. tenue (Menegh.) Gom. 2–6, 9–11.
Very common and generally distributed.

P. Bohneri Schmidle.
WK. In soil, Edgbaston and Harborne. ST. West Bromwich.

P. Retzii (Ag.) Gom. 6.
WS. Hagley.

P. inundatum Kütz. 5.
WK. Lapworth.

P. corium (Ag.) Gom. 5.
WK. Solihull.

P. autumnale (Ag.) Gom. 2–4, 9–12.
Very common, especially on damp ground.

LYNGBYA Ag.

L. Martensiana Menegh. 10.
WK. Studley. ST. Great Barr Park. The closely similar species, *L. Kützingii* Schmid., is recorded in soil from all three counties. See Bristol, Annal. Bot., 1920.

L. ochracea (Kütz.) Thur. 1–12.
WK. Common; Sutton Park, in great plenty. ST. Great Barr Park. This species has been usually considered to be a filamentous Schizomycete, viz. a *Leptothrix*.

L. major Menegh. 5, 10.
WK. Studley, very fine specimens. ST. Great Barr Park.

SYMPLOCA Kütz.

S. muralis Kütz. 8.
WS. [Wyre Forest, on damp earth, *W. J. H.*]

PLECTONEMA Thur.

P. Battersii Gom.
ST. In soil only, Baggeridge and Tettenhall.

ARTHROSPIRA Stizenb.

A. Jenneri Stiz. 6, 8, 10.
WS. Among species of *Spirogyra*, King's Norton; Bewdley, *W. J. H.*

SPIRULINA Turp.

S. tenuissima Kütz. 7.
WS. [In brackish water, Droitwich, *W. J. H.*]

NOSTOC Vauch.

N. paludosum Kütz. 1, 6.
WK. Hampton-in-Arden, etc. WS. Trimpley.

N. muscorum Ag.
WK. In soil, Edgbaston; Harborne. WS. In soil, California, near Harborne. ST. In soil, Sedgley.

N. foliaceum Moug.
WS. In soil, Chadwick. First record for Great Britain. The

same, or an allied species, has occurred in soil at Gravelly Hill (WK.) and at Baggeridge (ST.). See Bristol, Ann. Bot., 1920.

N. microscopicum Carm. 5.

WK. Hampton-in-Arden.

N. sphæroides Kütz.

ST. Baggeridge. Recorded also from soil, Kettering: the first records for Great Britain, *B. M. B.*

ANABÆNA Bory.

A. variabilis Kütz.

WS. In soil, California, near Harborne.

A. laxa (Rabenh.) A. Br. 5.

WS. King's Norton.

A. inæqualis (Kütz.) Born. & Flah. 6–8.

WK. In soil, Harborne. WS. King's Norton, *W. J. H.*; California, near Harborne. ST. In soil, Sedgley.

A. Flos-aquæ (Lyng.) Bréb. 8.

WK. In plankton, Bracebridge, Windley and Powell's Pools, Sutton Park. WS. King's Norton.

A. Hassallii (Kütz.) Wittr. 8.

WK. In plankton, Bracebridge Pool, Sutton Park.

A. circinalis (Kütz.) Hansg. 8.

WK. In plankton, Windley and Powell's Pools, Sutton Park.

A sphærica Born. & Flah.

WS. In soil, California, near Harborne. ST. In soil, Sedgley. First records for Great Britain; see Bristol, *l. c.* 1920, p. 63.

A. oscillarioides Bory. 7.

WS. King's Norton.

Var. *terrestris* Bristol, f. *minor.*

WK. In soil, Edgbaston. See Bristol, New Phytol. 1919, xviii. 102.

APHANIZOMENON Morr.

A. Flos-aquæ (L.) Ralfs. 8, 10.

WK. In plankton, Windley and Powell's Pools, Sutton Park; Canal, Lapworth. WS. In the moat, Harvington Hall.

CYLINDROSPERMUM Kütz.

C. majus Kütz.

WS. Halesowen, *W. J. H.*; in soil, California and Northfield.

C. stagnale (Kütz.) Born. & Flah. 7–11.

WK. Bogs I and III, Sutton Park. WS. Pond near Hawkesley Hall, King's Norton.

C. licheniforme (Bory) Kütz.

WK. In soil, Edgbaston.

C. muscicola Kütz.

WK. In soil, Harborne. WS. In soil, Chadwick. First records for Great Britain, *B. M. B.*

C. catenatum Ralfs. 9.

WS. On damp ground, Wyre Forest.

C. marchicum Lemm. f. *tenue* Bristol, *l. c.* 1920, p. 64.

WK. In soil, Harborne. First record.

NODULARIA Mert.

N. spumigena Mert. 1–12.
WS. Stapenhall Farm, King's Norton.
N. Harveyana (Thwaites) Thur.
ST. In soil, Baggeridge.

TOLYPOTHRIX Kütz.

T. tenuis Kütz. 1.
WS. Trimpley.
T. lanata (Desv.) Wartm. 3, 4.
WK. Sutton Park. WS. Halesowen.

SCYTONEMA Ag.

S. javanicum (Kütz.) Born.

WS. In soil, Harborne. These spores never completely developed, but it is probable that they were the spores of the above-named species, which has been found in soil from Wiltshire. See Bristol, *l. c.* 1920, p. 65. First record in Britain.

RIVULARIA Ag.

R. dura Roth. 6–8.
WS. In ponds. Barnt Green, on stems of aquatic plants.

GLAUCOCYSTIS Itzig.

G. Nostochinearum Itzig. 1, 2, 11.
WS. Stapenhall Farm pond, King's Norton; Trimpley, abundant.

PERIDINIEÆ.

HEMIDINIUM Stein.

H. nasutum Stein. 5.

WK. [Botanic Gardens, Edgbaston, *W. J. H.*]; Sutton Park, *T. Bolton.*

GYMNODINIUM Stein.

G. æruginosum Stein. 4, 5.
WK. In ponds, Berkswell.
G. sp. (allied to *G. tenuissimum* Lauterb.). 1.

WK. Pond at Stapenhall Farm, King's Norton, Jan. 1919, *W. J. H.* These specimens were seen by Professor West, who said that they were probably the same species as some he had found previously in a pond near Birmingham (exact locality not mentioned); he gave it the name *G. Campylodiscus*, but seems to have left no description. It is not certain that the two forms were identical.

[Length 42–50 μ, breadth about 38 μ, thickness 5–7·5 μ. The cells are remarkably flattened on both sides, and frequently have a slight spiral twist. Chromatophores numerous, light brown; no stigma. Anterior extremity of cell somewhat apiculate. This form, if not identical with *G. tenuissimum* Lauterb., is at any rate closely allied to it.—*W. J. H.*]

GLENODINIUM Stein.

Gl. Pulvisculus (Ehr.) Stein. 2, 3, 5, 8.

WK. Bracebridge Pool, Sutton Park; Earlswood. WS. King's Norton; Quinton.

Gl. cinctum (Müll.) Ehr. 1–12.

WK. Bogs II and III, Sutton Park.

Gl. uliginosum Schilling. 2–12.

WK. Bogs I, II (rare), and III, Sutton Park; Berkswell. WS. Barnt Green.

PERIDINIUM Ehrenb.

P. minimum Schill. 5, 6, 8–10.

WK. In the plankton, Sutton Park, new to Britain. Also recorded from the neighbourhood of Tewkesbury.

P. bipes Stein. 5.

WK. In ponds, Berkswell. WS. Hawkesley Hall, King's Norton.

P. aciculiferum Lemm. 1, 2, 3, 12.

WK. In the plankton, Sutton Park.

P. pusillum (Pen.) Lemm. 7.

WK. Bog III, Sutton Park. A slightly doubtful record.

P. cinctum (Müll.) Ehr. 5, 6, 10.

WK. In ponds, Berkswell; Olton Reservoir. WS. Halesowen. (Also from Tewkesbury.)

Var. *Lemmermanni* G. S. West, New Phytol. 1909, viii. 190. 4–11.

WK. In the plankton of Bracebridge, Blackroot, and Windley Pools, Sutton Park. WS. Pond at Hawkesley Hall, King's Norton.

P. anglicum G. S. West, New Phytol. 1909, viii. 187. 1–6, 8–12.

WK. In the plankton, Sutton Park. WS. Stanklin Pool, near Kidderminster. ST. Great Barr Park; Quarry House, Hamstead. Also from near Tewkesbury.

CERATIUM Schrank.

C. hirundinella (Müll.) Schrank. 4–11.

WK. In the plankton of Bracebridge, Blackroot, and Powell's Pools, Sutton Park; Olton Reservoir. WS. Stanklin Pool and Spring Grove, Kidderminster.

C. cornutum (Ehr.) Clap. & Lachm. 4, 5.

WS. In a field pond, Illey Lane, Halesowen, *W. J. H.*

BACILLARIEÆ.

MELOSIRA Ag.

M. varians Ag. 3–6, 8–11.

WK. Very frequent. WS. Very frequent. ST. Barr Beacon; Great Barr Park.

M. arenaria Moore. 6.

WK. Bradnock's Marsh; Hampton-in-Arden.

M. granulata (Ehr.) Ralfs. 5, 6, 9–11.

WK. Lapworth; Shirley, R. Cole; Earlswood. WS. Lifford, in the Canal. ST. Great Barr Park.

Var. *spinosa* Schröd. 10.

ST. Great Barr Park.

CYCLOTELLA Kütz.

C. operculata Kütz. 5, 6.

WK. Lapworth; Bracebridge Pool, Sutton Park.

C. Meneghiniana Kütz. 6, 10.

WK. Shirley, *W. J. H.*; Sutton Park; Olton Reservoir.

C. Kutzingiana Chauv. 5. 6. 10.

WK. Bradnock's Marsh; Lapworth; Studley; Shirley. ST. Great Barr Park.

STEPHANODISCUS Ehrenb.

S. Hantzschianus Grun. 10.

ST. Great Barr Park.

RHIZOSOLENIA Ehrenb.

R. morsa W. & G. S. West. 9.

WS. Lifford Canal, an unusual habitat.

TABELLARIA Ehrenb.

T. fenestrata (Lyngb.) Kütz. 1–5, 7, 10–12.

WK. Berkswell; Knowle; in a ditch and in the plankton of Bracebridge Pool, Sutton Park. WS. Hawkesley Hall, King's Norton.

T. flocculosa (Roth.) Ktz. 1–7, 9–12.

WK. Earlswood; Solihull; Harborne; in the plankton of Bracebridge Pool and in Bog III, Sutton Park. WS. Warley. ST. Bearwood.

DENTICULA Kütz.

D. tenuis Kütz. 9, 10.

WK. Studley. WS. Wyre Forest.

MERIDION Ag.

M. circulare Ag. 2, 4–6.

WK. Coleshill; Whitacre; Henley-in-Arden; Solihull; Bog II, Sutton Park. WS. Quinton.

Var. *constrictum* Van H. 3–5.

WK. Earlswood. WS. Clent. ST. Barr Beacon; Pool House Farm.

DIATOMA DC.

D. vulgare Bory. 1, 4–7, 10, 11.

WK. Bradnock's Marsh; R. Blythe; Berkswell; Hampton; Earlswood; Solihull; Studley; in a ditch, Sutton Park. WS. Wyre Forest; Warstock; King's Norton. ST. Great Barr Park.

D. elongatum Ag. 2–6, 9, 10.

WK. Coleshill; Whitacre; Hampton-in-Arden; Lapworth; Earlswood; Knowle; Studley; in a ditch and in plankton, Sutton Park. WS. Wyre Forest; Barnt Green. ST. Great Barr Park; Himley Park; Quarry House, Hamstead. (It was also brought from the neighbourhood of Tewkesbury.)

D. parasiticum W. Sm. 6, 7. 10.

WK. Hampton-in-Arden (on *Nitzschia sigmoidea*); Bog II, Sutton Park (on *Cymatopleura Solea*).

Fragilaria Lyngb.

F. virescens Ralfs. 5, 6, 8, 10.

wk. Berkswell; Lapworth. ws. Churchill; Hagley. st. Great Barr Park; Manley Hall, Weeford.

F. crotonensis (A. M. Edw.) Kitton. 2, 3, 5, 6, 8–11.

w.k. Lapworth; Earlswood; Olton; in the plankton of Bracebridge Pool, Sutton Park.

F. capucina Desm. 1–8, 10–12.

Very frequent and generally distributed.

F. construens (Ehr.) Grun., var. *binodis* Grun. 7.

wk. Bog. II, Sutton Park.

F. mutabilis (W. Sm.) Grun. 2–7, 9–11.

wk. Bradnock's Marsh; Shirley; in the plankton of Bracebridge Pool and in ditches, Sutton Park.

ws. King's Norton, *W. J. H.*

Synedra Ehrenb.

S. pulchella Ktz. 1–12.

Very frequent and generally distributed.

S. Acus (Ktz.) Grun. 2–6, 8, 10–12.

Common and generally distributed.

Var. *delicatissima* Grun. (=*S. delicatissima* W. Sm.). 4, 5, 9–11.

wk. Earlswood; in the plankton of Bracebridge and Windley Pools, Sutton Park. ws. Barnt Green. Lifford Canal.

S. radians (Ktz.) Grun. 3, 4, 6, 8–11.

wk. Shirley; Harborne; Bog II, Sutton Park; Olton. ws. Wyre Forest; Churchill; Hawkesley Hall, King's Norton; st. Great Barr Park.

S. Ulna (Nitzsch.) Ehr. 1–7, 9–12.

Very common and generally distributed.

S. actinastroides Lemm. 9, 10.

ws. In the Canal, Lifford. New to Britain.

S. capitata Ehr. 5, 10.

st. Great Barr Park.

Asterionella Hassall.

A. formosa Hass. 1–12.

wk. Lapworth; Shirley; Olton Reservoir; in the plankton of Bracebridge, Blackroot and Windley Pools, Sutton Park. ws. Barnt Green; Cofton Reservoir; in the Canal at Lifford. st. Great Barr Park.

Ceratoneis Ehrenb.

C. Arcus Ktz. 3, 5, 6.

wk. Whitacre; Henley-in-Arden; Earlswood; Sutton Coldfield.

Eunotia Ehrenb.

E. Arcus Ehr. 1, 3, 5, 9.

wk. In Bog I, Sutton Park. ws. Wyre Forest; Trimpley. st. Great Barr Park.

*

E. major (W. Sm.) Rabenh. 3, 6, 10.

wk. In Bog I, Sutton Park.

E. gracilis (Ehr.) Rab. 1–3, 5, 7, 9, 10.

wk. Whitacre; in Bogs I, II, and III, Sutton Park. ws. Trimpley; Hartlebury Common. st. Great Barr Park.

E. pectinalis (Ktz.) Rabenh. 2–5, 10, 12.

wk. Coleshill; Henley-in-Arden; Chelmsley Wood; Earlswood; Yardley; in Bogs I & II, Sutton Park. ws. Quinton; Hawkesley Hall, King's Norton. st. Great Barr Park; Bearwood.

Var. *undulata* Ralfs. 5, 12.

wk. In Longmoor Pool, Sutton Park. ws. In the Canal, Droitwich.

E. Soleirolei Kütz. 4, 6.

wk. Berkswell. ws. Warley. st. Bearwood.

E. incisa Greg. (= *E. Veneris* Kütz.). 5, 11.

wk. Coleshill; Bracebridge Pool, Sutton Park.

E. lunaris (Ehr.) Grun. 1–7, 9, 10, 12.

Very common and generally distributed.

Var. *bilunaris* (Ehr.) Grun. 4.

ws. Quinton.

Achnanthes Bory.

A. brevipes Ag. 12.

ws. In the Canal, Droitwich.

The presence of this marine species is accounted for by the salt springs in the neighbourhood.

A. coarctata Bréb. 3, 5, 6.

wk. Whitacre; Solihull; Bog II, Sutton Park. ws. Clent; Harvington Hall.

A. subsessilis Kütz. 7.

ws. In salt water, Droitwich.

A. microcephala Kütz. 4, 5, 9, 10.

wk. Henley-in-Arden; Sutton Coldfield. ws. Wyre Forest; Quinton. st. Great Barr Park.

Material brought from Tewkesbury was also found to contain this species.

A. exilis Kütz. 4–6, 10, 11.

wk. Coleshill; Lapworth; Studley; Bracebridge Pool, Sutton Park. ws. Clent; Halesowen. st. Himley Park; Quarry House, Hamstead.

A. linearis W. Sm. 4–6, 9, 10.

wk. Henley-in-Arden; Hampton-in-Arden; Lapworth; Shirley; Olton; Studley. ws. Wyre Forest; Barnt Green.

A. lanceolata Bréb. 3–5.

ws. Quinton; King's Norton. st. Bearwood.

Achnanthidium Kütz.

A. flexellum Bréb. 4.

wk. Bog II, Sutton Park.

Navicula Bory.

N. nobilis Ehr. 2, 4, 5, 7, 10–12.

wk. Berkswell; Earlswood; Bog II and Bracebridge Pool, utton Park. ws. Clent; King's Norton.

Var. *Dactylus* (Ehr.) Van H. 11.

WK. Bog II, Sutton Park.

N. major Kütz. 1–12.

WK. Berkswell; Shirley; Earlswood; Bogs I, II, III, in ditch and in Bracebridge Pool, Sutton Park. WS. Warley; Alvechurch; Trimpley; Quinton; King's Norton. ST. Bearwood; Great Barr Park.

N. viridis Kütz. 1–12.

Common and generally distributed.

N. borealis Ehr. 1, 3, 5–7, 9, 12.

WK. Berkswell; Earlswood; Sutton Park; in three soils, Edgbaston; in soil, Gravelley Hill and Harborne. WS. In the Canal, Droitwich; Wyre Forest; in soil, California. ST. In soil, Baggeridge Woods and Bearwood.

N. Balfouriana Grun.

Found only in cultures of soils from this district:—

WK. Edgbaston; Harborne. WS. California; Chadwick; Warley. ST. Baggeridge Woods; Himley; Gospel End.

N. divergens W. Sm. 2, 5, 7, 10.

WK. Lapworth; Studley; Bogs I and II, Sutton Park.

N. Brebissonii Kütz. 1–7, 10–12.

Common and generally distributed.

Var. *minuta* Van H. (soil form).

WK. Edgbaston; Harborne. WS. Northfield; Chadwick; California. ST. Gospel End; Sedgley; Baggeridge Woods.

N. intermedia Lagerst.

Found only in cultures of soils in this district:—

WK. Edgbaston; Harborne. WS. California. ST. Tettenhall.

N. Tabellaria Ehr. 1–11.

WK. In Bogs I and II, Sutton Park.

N. gibba Kütz. 3–8, 10–12.

WK. Studley; Bogs I, II, III, and in ditch, Sutton Park.

N. appendiculata Kütz. 1–12.

WK. Berkswell, Lapworth, Bogs I and III, Sutton Park. WS. Quinton.

N. mesolepta Ehr. 2–11.

WK. Earlswood; Studley; Bogs I and III, Sutton Park. WS. Wyre Forest; Quinton; King's Norton.

N. oblonga Kütz. 4, 5, 9.

WK. Solihull. WS. Wyre Forest. ST. Great Barr Park.

N. peregrina Kütz. 7, 12.

WS. In the Canal, Droitwich.

The occurrence of this species is evidently the result of the high salinity of the water in this place.

N. gracilis Kütz. 1, 3–8, 10, 12.

WK. Bradnock's Marsh; Whitacre; Berkswell; Lapworth; Studley; Hampton-in-Arden; Bog II and Bracebridge Pool, Sutton Park. WS. Wyre Forest; Alvechurch; Warstock; Harvington Hall; Clent; Churchill; Hagley; Barnt Green. ST. Great Barr Park.

N. viridula Kütz. 6, 7, 10.

WK. River Blythe. WS. Alvechurch; Warstock. ST. Himley Park.

Var. *slesvicensis* (Grun.) Van H. 4.

WS. Quinton.

N. avenacea Bréb. 10.

ST. Great Barr Park.

N. radiosa Kütz. 1–12.

Common and generally distributed.

Var. *acuta* (W. Sm.) Van H. 4, 6, 7, 9, 10.

WK. Olton; Bog II and Bracebridge Pool, Sutton Park. ST. Great Barr Park.

N. cryptocephala Kütz. 4–6, 10, 11.

WK. Lapworth; Shirley; Olton Reservoir; Solihull; Studley. WS. Alvechurch; Barnt Green. ST. Oldhill; Great Barr Park.

N. rhynchocephala Kütz. 4–6, 10, 11.

WK. River Blythe; Lapworth; Shirley; Bog II, Sutton Park. WS. Quinton; Barnt Green; Warley. ST. Bearwood; Great Barr Park; Himley Park.

N. anglica Ralfs. 4–6, 10.

WK. Bradnock's Marsh; Henley-in-Arden; Berkswell; Lapworth; Bracebridge Pool, Sutton Park. ST. Great Barr Park; Quarry House, Hamstead.

N. Semen Ehr. 5.

WK. Lapworth.

N. dicephala W. Sm. 5, 6.

WK. Henley-in-Arden. WS. Wyre Forest; Alvechurch.

N. interrupta Kütz. 4, 6, 10.

WK. Bogs I, II, and III, Sutton Park.

N. ovalis Hilse. 3.

WK. Bog II, Sutton Park.

N. elliptica Kütz. 1–6, 8–12.

WK. Bradnock's Marsh; Hampton-in-Arden; Bog II, Sutton Park. WS. Hartlebury Common; Wyre Forest; Clent; Quinton.

Var. *minima* Van H.

WK. In soil, Harborne.

N. terricola Bristol, *l. c.* 1920, p. 67.

WK. In soil, Harborne.

N. hyalina Donk. var. *minima* Bristol, *l. c.* 1920, p. 68.

ST. In soil at Sedgley and Tettenhall.

N. mutica Kütz. 5.

ST. Great Barr Park, in pool. This species, though rarely found in ponds, etc., occurred in the cultures of a good many soils, *e. g.*:—WK. Edgbaston; Harborne. WS. Warley. ST. West Bromwich; Cospel End; Sedgley; Himley.

Var. *quinquenodis* Del.

ST. In soil, Sedgley; in soil, Himley Park.

N. cuspidata Kütz. 3–11.

WK. Berkswell; Lapworth; Bog II, in a ditch and in the plankton of Bracebridge Pool, Sutton Park. WS. Alvechurch; Harvington Hall; Quinton; in the Canal, Lifford; King's Norton; Halesowen. ST. Great Barr Park.

N. sphærophora Kütz. 4–6, 10.

WK. Henley-in-Arden; Studley; Bog II, Sutton Park. WS. Alvechurch. ST. Great Barr Park.

N. exilis Grun. 2–7, 9–12.

Very common and generally distributed.

N. amphisbæna Bory. 3, 5, 6, 10, 11.

WK. Lapworth; Earlswood; Bradnock's Marsh; Hampton-in-Arden. WS. Alvechurch. ST. Great Barr Park.

N. limosa Kütz. 1–6, 9–11.

WK. Bogs I and II and Bracebridge Pool, Sutton Park. WS. Wyre Forest; Alvechurch. ST. Great Barr Park.

Var. *gibberula* (Kütz.) Van H. 5.

WK. Lapworth.

N. Iridis Ehr. (=*N. firma* W. Sm., *non* Kütz.). 3–7, 10, 11.

WK. Berkswell; Bog II, in a ditch, and in the plankton of Bracebridge Pool, Sutton Park. WS. Clent; Warley.

Var. *amphigomphus* (Ehr.) Van H. 12.

WS. In the Canal, Droitwich.

Var. *amphirhynchus* Ehr. 1, 2, 4–6, 10.

WK. Hampton-in-Arden; Bogs I and III, Sutton Park. WS. Quinton. ST. Manley Hall, Weeford.

Var. *affinis* (Ehr.) Van H. 1, 4–8, 10, 11.

WK. Berkswell; Hampton-in-Arden; Shirley; Bogs I and II and in plankton of Bracebridge Pool, Sutton Park. WS. Warstock; Quinton. ST. Barr Beacon; Manley Hall, Weeford.

Var. *producta* (W. Sm.) Van H. 1, 3, 6, 10.

WK. Studley; Bog II and Bracebridge Pool, Sutton Park. WS. Halesowen.

N. Pupula, Kütz. 4, 6.

WK. Hampton-in-Arden, *W. J. H.*; Bradnock's Marsh; in soil, Edgbaston. WS. Barnt Green. ST. In soils, Baggeridge Woods and Himley Park.

N. Atomus Näg.

This species has been found in no ponds, etc., but appeared in the cultures of a number of different soils:—

WK. Edgbaston; Harborne. WS. Warley. ST. West Bromwich; Sedgley; Baggeridge Woods.

N. contenta Grun. var. *biceps* Del.

Found only in cultures of soils:—

WK. Edgbaston; Harborne. WS. Northfield. ST. Gospel End; Sedgley; Tettenhall.

N. confervacea Kütz. 11.

WK. Shirley.

COCCONEIS Ehrenb.

C. Pediculus Ehr. 3–6, 9, 10.

WK. Hampton-in-Arden; in the Lake, Lapworth; Yardley; Studley. WS. Harvington Hall; Wyre Forest; Alvechurch; Hagley; Barnt Green. ST. Great Barr Park; Himley Park.

C. Placentula Ehr. 1, 3–6, 9, 10.

Common and generally distributed.

STAURONEIS Ehrenb.

St. Phœnicenteron Ehr. 1, 2, 4–12.

WK. Henley-in-Arden; Berkswell; Knowle; Yardley; Bogs II and III and Bracebridge Pool, Sutton Park. WS. Quinton. ST. Great Barr Park.

St. gracilis Ehr. 3.

WK. Bracebridge Pool, Sutton Park.

St. acuta W. Sm. 1, 7, 11.

WK. Bog II, Sutton Park.

St. anceps Ehr. 4–6, 8.

WK. Berkswell; Knowle; Bog II and Bracebridge Pool, Sutton Park. WS. Barnt Green; King's Norton.

VANHEURCKIA Bréb.

V. rhomboides Bréb. var. *saxonica* Rab. 3, 5, 6, 11.

WK. Bog I and Bracebridge Pool, Sutton Park. WS. Bog on Hartlebury Common.

V. vulgaris (Thw.) Van H. 5, 6.

WK. Bog II, Sutton Park; Harborne. WS. California; Clent (more narrow and blunt than is usual).

AMPHIPLEURA Kütz.

A. pellucida Kütz. 4, 5, 7, 10.

WK. Studley; Bracebridge Pool, Sutton Park. WS. Halesowen. ST. Quarry House, Hamstead.

PLEUROSIGMA W. Sm.

P. attenuatum W. Sm. 1, 5, 6, 10–12.

WK. River Blythe; Studley; Lapworth; Shirley; in the plankton of Bracebridge Pool, Sutton Park. WS. Clent. ST. Great Barr Park.

P. acuminatum (Kütz.) Grun. (=*P. lacustre* W. Sm.). 4–6, 9–11.

WK. Hampton-in-Arden; Earlswood; Studley; in the plankton, Sutton Park. WS. Alvechurch; Hagley; Barnt Green; in the Canal, Lifford. ST. Great Barr Park.

P. Spenceri (Quek.) W. Sm. 1, 3, 5, 6, 8–11.

WK. Henley-in-Arden; Earlswood; in the plankton of Bracebridge Pool, Sutton Park. WS. Wyre Forest; Clent; Halesowen. ST. Barr Beacon; Great Barr Park.

P. scalproides Rab. 4.

WS. Barnt Green.

AMPHIPRORA Kütz.

A. paludosa W. Sm. 6, 7.

WK. Studley.

RHOICOSPHENIA Grun.

R. curvata (Kütz.) Grun. 4–6, 10, 11.

WK. Bradnock's Marsh; Coleshill; Berkswell; Shirley; Earlswood; Solihull; Studley. WS. Wyre Forest; Alvechurch; Hagley; Barnt Green. ST. Great Barr Park.

GOMPHONEMA Ag.

G. constrictum Ehr. 1–6, 9–12.

Common and generally distributed.

G. acuminatum Ehr. 4–8, 10, 11.

WK. Bradnock's Marsh; Coleshill; Shirley; Olton Reservoir; in Bog II and Bracebridge Pool, Sutton Park. WS. Clent; Churchill; Barnt Green; King's Norton. ST. Great Barr Park.

G. Augur Ehr. 5, 6, 10.

WK. Hampton-in-Arden; River Blythe; Bracebridge Pool, Sutton Park.

G. parvulum Kütz. 3–6, 9–11.

WK. Bradnock's Marsh; Coleshill; Earlswood; Shirley; Bog II and Bracebridge Pool, Sutton Park. WS. Wyre Forest; Barnt Green; Hawkesley Hall, King's Norton.

G. gracile Ehr. 5.

WK. Berkswell.

G. dichotomum W. Sm. 3, 4, 10.

WK. Earlswood; Studley. WS. Barnt Green.

G. intricatum Kütz. 1, 4–6, 8, 10.

WK. Henley-in-Arden; Chelmsley Wood; Shirley; Studley; Bog II, Sutton Park. WS. Trimpley; Barnt Green; Hawkesley Hall, King's Norton.

G. Vibrio Ehr. 2, 5, 6, 9, 10.

WK. Whitacre; Studley; Bog II, Sutton Park. WS. Wyre Forest; Fenny Rough.

G. angustatum Kütz. 4.

WK. Quinton.

G. olivaceum Kütz. 3, 6.

WK. Berkswell. WS. King's Norton, *W. J. H.*; Barnt Green.

G. tenellum Kütz. 5–7, 10.

WK. Henley-in-Arden; Studley; Bog II, Sutton Park. WS. Westhills. ST. Great Barr Park.

CYMBELLA Ag.
(incl. *Cocconema*, *Encyonema*).

C. Ehrenbergii Kütz. 2–4, 6–8, 12.

WK. Bradnock's Marsh; in the plankton of Bracebridge Pool, Sutton Park. WS. Quinton; Barnt Green.

C. cuspidata Kütz. 4, 6–8, 10, 12.

WK. Berkswell; Bog II and in ditch, Sutton Park.

C. gastroides Kütz. 1–4, 6, 7, 10–12.

WK. Coleshill; Bog II, in ditch and in plankton of Bracebridge Pool, Sutton Park. WS. Wyre Forest; King's Norton.

C. lanceolata Ehr. 1, 3–6, 9–12.

Common and generally distributed.

C. cymbiformis Ehr. 3, 5–7, 9, 10.

WK. Hampton-in-Arden; Berkswell; Olton; Studley; Bog II and Bracebridge Pool, Sutton Park. WS. Wyre Forest; Alvechurch. This species was also collected at Tewkesbury.

C. parva W. Sm. 9, 10.

WK. Studley. WS. Wyre Forest.

C. parvula Kütz.

WK. Studley.

C. Cistula Hemp. 1, 2, 4–6, 10, 11.

WK. Bradnock's Marsh; Hampton-in-Arden; Lapworth; Olton; Studley; in the plankton of Bracebridge Pool, Sutton Park. WS. Barnt Green; King's Norton. ST. Great Barr Park.

C. maculata Kütz. 4–6.

WK. Lapworth. WS. Alvechurch; Barnt Green. ST. Great Barr.

§ Encyonema.

Cymbella prostrata Berk. 3, 5, 6.
WK. River Blythe. WS. Quinton, *W. J. H.* ST. Great Barr Park.
C. turgida Greg.
WK. River Blythe. WS. Quinton, *W. J. H.* ST. Great Barr Park.
C. ventricosa Ehr. 3, 6, 10.
WK. In the plankton of Bracebridge Pool, Sutton Park.
C. cæspitosa Kütz. 5, 10, 11.
WK. Bracebridge Pool, Sutton Park. ST. Great Barr Park.
C. gracilis Rabenh. 5.
WK. Lapworth.

MASTOGLOIA Thwaites.

M. Smithii Thw. 6.
WK. Rowton's Well, Sutton Park (probably this species, but the name is miswritten "*Mastogloia Thwaitesii*").

AMPHORA Ehrenb.

A. ovalis (Bréb.) Kütz. 1, 3–10.
WK. Bradnock's Marsh; Henley-in-Arden; Hampton-in-Arden; Lapworth; Olton Reservoir (very small); Studley; Bog II, and plankton of Bracebridge and Blackroot Pools, Sutton Park. WS. Wyre Forest; King's Norton. ST. Great Barr Park; Himley Park; Quarry House, Hamstead.
Var. *Pediculus* (Kütz.) Van H. 6.
WK. Hampton-in-Arden.
A. minutissima W. Sm. 5, 6.
WK. Bradnock's Marsh; Hampton-in-Arden; Henley-in-Arden. ST. Great Barr Park.

EPITHEMIA Bréb.

E. turgida (Ehr.) Kütz. 1, 4–7, 9–12.
WK. Henley-in-Arden; Berkswell; Lapworth; Knowle; Yardley; Studley; Bog II and in the plankton of Bracebridge Pool, Sutton Park. WS. Wyre Forest; Trimpley; Barnt Green; Hawkesley Hall, King's Norton, ST. Great Barr Park.
Var. *Westermanni* Kütz. 5.
WK. Henley-in-Arden.
E. Sorex Kütz. 2, 4, 6, 10 ,11.
WK. Yardley. WS. Barnt Green; Stapenhall Farm, King's Norton. ST. Great Barr Park.
E. gibba Kütz. 1, 4, 7–11.
WK. Studley; Bog II and plankton of Bracebridge Pool, Sutton Park.
Var. *ventricosa* (Kütz.) Van H. 6, 10.
WK. Berkswell; Bracebridge Pool, Sutton Park.
E. Argus Kütz. 9.
WK. Bog II, Sutton Park.
E. gibberula Kütz. 6.
WK. Bracebridge Pool, Sutton Park.

RHOPALODIA O. Müll.

R. gibba (Kütz.) O. M. 2, 9, 10.

WK. Bog II, Sutton Park. WS. Wyre Forest. ST. Great Barr Park.

NITZSCHIA Hassall.

N. Tryblionella Hantzsch (or allied sp.). 5, 10.

WK. Studley. ST. Great Barr Park.

N. constricta (Greg.) Grun. 5, 7.

WS. Clent; Droitwich.

N. dubia W. Sm. 5, 6, 10, 11.

WK. Earlswood. WS. Alvechurch. ST. Barr Beacon.

N. vivax W. Sm. 9.

WK. Bog II, Sutton Park.

N. sigmoidea W. Sm. 4–7, 9–12.

Common and generally distributed.

N. Sigma W. Sm. 2–6, 10.

WK. Bradnock's Marsh; Henley-in-Arden; Lapworth; Studley; Earlswood; Bog III, Sutton Park. WS. Hartlebury Common; Alvechurch; Hagley. ST. Great Barr Park; Quarry House, Hamstead.

Var. *curvula* (Ehr.) Grun. 4, 10, 11.

WK. Earlswood; Bog III, Sutton Park. WS. Barnt Green.

N. obtusa W. Sm. var. *scalpelliformis* Grun. 4.

WK. Harborne. WS. King's Norton.

N. linearis (Ag.) W. Sm. 1–12.

WK. Coleshill; River Blythe; Henley-in-Arden; Hampton-in-Arden; Berkswell; Lapworth; Earlswood; Solihull; Studley; Bog II, ditch and Bracebridge Pool, Sutton Park. WS. Wyre Forest; Alvechurch; Warstock; Harvington Hall; Clent; Hagley; Halesowen; Quinton; King's Norton. ST. Barr Beacon; Great Barr Park.

Var. *tenuis* Grun. 1, 4–6, 9–11.

WK. Hampton-in-Arden; Lapworth; Earlswood; Solihull; Bog II, Sutton Park. WS. In the Canal, Lifford. ST. Great Barr Park.

N. Palea (Kütz.) W. Sm. 1–12.

WK. Very common. WS. Very common, ST. Barr Beacon; Great Barr Park; Himley Park; Quarry House, Hamstead; in soil cultures, Baggeridge Woods.

Var. *debilis* Van H. 9, 11.

WK. Shirley. WS. Wyre Forest.

Var. *fonticola* Grun.

WK. In soil cultures, Edgbaston.

N. inconspicua Grun. (Found only in cultures of soils.)

WK. Edgbaston; Harborne. WS. California. ST. Sedgley. First records for the British Islands.

N. acicularis W. Sm. 3–6, 8–11.

Common and generally distributed.

HANTZSCHIA Grun.

H. Amphioxys (Ehr.) Grun. 2, 3, 5, 6.

WK. Hampton-in-Arden; Studley. WS. Halesowen. ST. Oldhill; Bearwood.

Var. *vivax* (Hantzsch) Van H. 4.

WS. Barnt Green.

BACILLARIA Gmel.

B. paradoxa Gmel.

ST. Disused arm of canal, Albion station, near West Bromwich, *T. Bolton*; small stream, near the same place, *A. W. Wills*.

CYMATOPLEURA Turp.

C. elliptica (Bréb.) W. Sm. 2, 3, 5, 7, 9–12.

WK. Earlswood; Bogs I and II and in ditch, Sutton Park.

Var. *hibernica* (W. Sm.) Van H. 5.

WK. Solihull.

C. Solea (Bréb.) W. Sm. 1, 4–7, 9–12.

WK. Bradnock's Marsh; Henley-in-Arden; Hampton-in-Arden; Shirley; Earlswood; Solihull; Bog II and in the plankton of Bracebridge Pool, Sutton Park. WS. Wyre Forest: Alvechurch; Clent; Barnt Green; King's Norton. ST. Great Barr Park.

SURIRELLA Turp.

S. linearis W. Sm. 1, 4–12.

WK. Bradnock's Marsh; Shirley; Bogs I, II, III and in the plankton of Bracebridge Pool, Sutton Park. WS. Hartlebury Common; Clent; Warley. ST. Bearwood; Great Barr Park.

S. biseriata Bréb. 1–3, 5–11.

WK. Shirley; Bogs II and III and in the plankton of Bracebridge Pool, Sutton Park. WS. In the Canal, Lifford.

S. robusta Ehr. (=*S. nobilis* W. Sm.=*S. splendida* W. Sm.). 1, 3–5, 7, 8, 11.

WK. Shirley; Bog II and in plankton of Bracebridge Pool, Sutton Park. ST. Great Barr Park.

Var. *splendida* (Ehr.) Van H. 1–8, 10–12.

WK. Bradnock's Marsh; Hampton-in-Arden; Earlswood; Bogs II and III and in the plankton of Bracebridge and Windley Pools, Sutton Park. WS. King's Norton.

S. striatula Turpin. 7, 12.

WS. In the Canal, Droitwich. Evidently owes its existence in this locality to the brine springs in the neighbourhood.

S. ovalis Bréb. 4–6, 10, 12.

WK. Bradnock's Marsh; Coleshill; Berkswell; Solihull; Studley. WS. Alvechurch; in the Canal, Droitwich. ST. Oldhill; Pool House Farm.

Var. *minuta* (Bréb.) Van H. 4–6.

WK. Henley-in-Arden; Earlswood; Solihull.

Var. *angusta* Kütz. 6.

WK. Berkswell. WS. Alvechurch.

Var. *pinnata* W. Sm. 3–6.

WK. Bradnock's Marsh; Studley; Hampton-in-Arden. WS. Halesowen; Quinton; Wyre Forest; Alvechurch. ST. Great Barr Park.

Var. *apiculata* (W. Sm.) Mills & Phill. Diatom. Hull, pl. 21, f. 24. 10.

WK. Bracebridge Pool, Sutton Park.

S. constricta W. Sm. 8.

WK. [Sutton Park, *W. J. H.*]

S. spiralis Kütz. 1–12.

WK. Bog II, Sutton Park. WS. Clent. See West, Journ. Bot. 1912, p. 325, fig. 2.

CAMPYLODISCUS Ehrenb.

C. hibernicus Ehr. 3, 6, 7, 10–12.

WK. Bradnock's Marsh; Shirley; in the plankton of Bracebridge Pool, Sutton Park.

CHLOROPHYCEÆ.

ISOKONTÆ.

PROTOCOCCALES.

POLYBLEPHARIDACEÆ.

PYRAMIMONAS Schmarda.

P. delicatulus Griffiths in New Phytol. 1909, p. 131, figs. 13–15.

WS. Stanklin Pool, near Kidderminster.

Pyramimonas sp. 4, 5.

WS. [Quinton, 1920. This species, which is not yet described, differs from both *P. delicatulus* Griffiths and *P. tetrarhynchus* Schmarda, and is probably new, *W. J. H.*]

SPHÆRELLACEÆ.

SPHÆRELLA Sommerf.

S. lacustris (Girod.) Wittr. 6.

ST. [Bearwood, *W. J. H.*]

CHLOROGONIUM Ehr.

C. euchlorum Ehrenb. 1, 4, 5, 12.

WK. Botanic Gardens, Edgbaston; Harborne; Bradnock's Marsh; Earlswood, in frogs' spawn. WS. Quinton; King's Norton. ST. Bearwood, *W. J. H.*

VOLVOCACEÆ.

CARTERIA Diesing.

C. multifilis (Fres.) Dill. 3, 5, 10–12.

WK. In plankton, Bracebridge Pool, Sutton Park; Canal, Lapworth; Earlswood. WS. King's Norton; Harvington Hall.

C. obtusa Dill.

WK. Botanic Gardens, Egbaston.

CHLAMYDOMONAS Ehr.

C. Reinhardi Dang. 5, 6.

WK. Edgbaston; Bradnock's Marsh. WS. King's Norton, *W. J. H.*

C. Pulvisculus (Müll.) Ehrenb. 5, 6.

WK. Berkswell; Lapworth. WS. King's Norton.

C. Debaryana Gorosch. 2, 5, 6, 10.

WK. Pond at Sutton Coldfield. WS. King's Norton; Hartlebury Common. ST. Himley Park.

C. communis Snow.

WS. In soil, Chadwick. New to Britain; see Bristol, in Annal. Bot. 1920, p. 72, with text-figs.

C. intermedia Chod. 4–6.

WK. In small farm-pond, Harborne.

C. monadina Stein (= *C. Braunii* Gorosh.). 2.

WS. Quinton, with anisogamous gametes and zygotes. The remarkable gametes of this species have not previously been recorded for this country, *W. J. H.*

C. gigantea Dill.

WK. [Harborne, *W. J. H.*]

C. variabilis Dang. 2, 4.

WK. In a small pond, Studley (forma *anglica*); see West, Journ. Bot. 1915, p. 76, fig. 2, A–E. WS. Quinton; World's End, Harborne.

C. globulosa Perty. 4, 5, 10, 11.

WK. Longmoor Pool, Sutton Park; in moat, Earlswood; Coleshill. See West, Journ. Bot. 1915, p. 74, fig. 1, D–F.

C. palatina Schmid. (Ber. Deutsch. Bot. Ges. 1903, xxi. 352). 3, 4.

WK. Harborne, in a small farm-pond. New to Britain.

C. pluristigma Bristol, in Annal. Bot. 1920, p. 72, with text-figs.

ST. In soil, Sedgley.

C. reticulata Gorosh.

WK. In ponds, Berkswell. New to Britain; see West, Journ. Bot. 1915, p. 74.

C. microscopica G. S. West in Journ. Bot. 1916, p. 1 (= *C. gracilis* G. S. West, *l. c.* 1915, p. 77, fig. 2, F–I, *non* Snow, 1903). 4, 5.

WK. In a boggy spring, Sutton Park.

C. elegans G. S. West, *l. c.* 1915, p. 77, fig. 2, J–O. 5.

WK. In a rain-pool, Sutton Park.

C. Grovei G. S. West, *l. c.* 1916, p. 6, fig. 4. 6, 7.

WK. In a water-butt, Studley Castle, in two successive years. WS. In a drinking-trough for horses, Dunhampstead.

This minute Alga has been found also at Cambridge; in all cases it occurred in great quantity, and was unaccompanied by any filiform Alga whatever.

POLYTOMA Ehr.

P. Uvella Ehr. 5.

WS. King's Norton, *W. J. H.* ST. Great Barr Park.

PHACOTUS Perty.

P. lenticularis Stein. 6.

WK. Berkswell.

PTEROMONAS Selig.

P. angulosa (Cart.) Dang. 10.

WK. In ponds, Berkswell; see West, Journ. Bot. 1916, p. 7, fig. 5.

P. Takedana G. S. West in Journ. Bot. 1916, p. 8, fig. 6 (=*P. angulosa* West, *ibid.* 1912, p. 330, *non* Dang.). 6.

WK. Earlswood Lakes. New to Britain; found also in Surrey.

P. Chodati Lemm. 10.

ST. Great Barr Park. New to Britain; see West, *l. c.* 1912, p. 331.

P. aculeata Lemm.

WS. Spring Grove Pools, near Stourport. See Griffiths, in Linn. Soc. Journ., Bot. 1916, p. 429, pl. 34, figs. 3–5.

P. ovalis Griffiths, *ibid.* p. 430, pl. 34, fig. 6.

WS. Spring Grove, Lower Pool, in very small numbers, associated with *P. aculeata.*

GONIUM Müll.

G. pectorale Müll. 5–7, 10, 11.

WK. Longmoor Pool, Sutton Park; Berkswell; Lapworth. WS. King's Norton; Barnt Green. ST. Great Barr Park.

G. sociale (Duj.) Warm. 5, 10, 11.

WK. Lapworth. WS. King's Norton.

G. lacustre G. S. West. 3–5.

WK. In the plankton, Sutton Park; Lapworth; Earlswood; Berkswell. WS. Barnt Green, etc.

PANDORINA Bory.

P. Morum (Müll.) Bory. 1–6, 10, 11.

WK. Common in many pools. WS. Quinton; King's Norton; Barnt Green; Trimpley, etc., etc. ST. Great Barr Park.

EUDORINA Ehr.

E. elegans Ehrenb. 1–12.

WK. In the plankton, Bracebridge Pool, Sutton Park; Sutton Coldfield, Berkswell, etc., etc. WS. King's Norton; Harvington Hall; Trimpley, etc.

In certain pools at Sutton Coldfield small ellipsoidal colonies were found.

PLEODORINA Shaw.

P. illinoisensis Kofoid. 3, 4.

WK. Harborne, in cart-ruts in a field; see Grove, in New Phytol. 1915, xiv. 169 and 1917, xvi. 180.

VOLVOX Ehr.

V. aureus Ehrenb. 1–6, 8, 9.

WK. Bracebridge Pool, Sutton Park; Harborne; Yardley; Olton Reservoir, etc. Not uncommon in spring with antheridia and oospores. WS. King's Norton, pond near Hawkesley Hall, with male colonies; Barnt Green; Trimpley, etc.

This species can be found all the year round, even under thick ice, by those who know its habits.

V. globator (L.) Ehrenb. 3–8.

WK. Yardley, intermixed with *V. aureus*. WS. King's Norton; Northfield; Westhills; in moat, Harvington Hall.

Undoubtedly more common than these records imply, but most of the specimens called by this name by collectors are *V. aureus*.

PALMELLACEÆ.

PALMODACTYLON Näg.

P. simplex Näg. 3.

WK. Bracebridge Pool, Sutton Park (somewhat doubtful).

P. varium Näg. 6.

WK. Sutton Park.

P. subramosum Näg. 5.

WK. Lapworth.

SPHÆROCYSTIS Chod.

S. Schröteri Chod. 6–9, 11.

WK. In the plankton, Bracebridge, Blackroot, and Windley Pools, Sutton Park; Olton Reservoir; Windmill Pool, Shirley.

COCCOMYXA Schmidle.

C. Solorinæ Chod. forma, Bristol in Annal. Bot. 1920, p. 73.

WK. In soil, Edgbaston. First record for the British Isles. ST. West Bromwich; Gospel End; Sedgley.

C. subellipsoidea Acton (=? *C. Nägeliana* Chod.).

WK. Edgbaston, on damp sandstone rocks and walls, and in greenhouses. WS. Quinton. See Acton, Annal. Bot. 1909, xxiii. 576.

APIOCYSTIS Näg.

A. Brauniana Näg. 5, 6, 9, 10.

WK. Bracebridge Pool, Sutton Park; Olton Reservoir, etc. WS. King's Norton.

SCHIZOCHLAMYS A. Br.

S. gelatinosa A. Br. 5–8.

WK. Sutton Park; Coleshill.

TETRASPORA Link.

T. gelatinosa (Vauch.) Desv. 4.

WK. In a ditch, Sutton Park; Volvox Pool, Yardley. WS. Quinton.

T. lubrica Ag. 3.

WK. Yardley.

GLŒOCYSTIS Näg.

G. vesiculosa Näg. 5–7.

WK. In the plankton, Bracebridge Pool, Sutton Park; Henley-in-Arden.

G. gigas (Kütz.) Lagerh. 1, 4–8, 10, 11.

WK. Sutton Park, Bogs II and III; plankton, Longmoor Pool; Olton Reservoir; Chelmsley Wood; Hampton-in-Arden; Lapworth. WK. King's Norton; Kidderminster, etc.

PALMODICTYON Kütz.

P. viride Kütz. 4.

WK. Berkswell; near Yardley Wood, *T. Bolton.* WS. Quinton.

ASTEROCOCCUS Scherff.

A. superbus (Cienk.) Scherff. (=*Glœocystis infusionum* W. & G. S. West). 4, 5, 7, 8, 10.

WK. Berkswell; Knowle. WS. King's Norton; Westhills; Hunnington.

DICTYOSPHÆRIACEÆ.

DICTYOSPHÆRIUM Näg.

D. Ehrenbergianum Näg. 4–6, 11.

WK. Olton. WS. Ponds near Hawkesley Hall and Stapenhall Farm, King's Norton.

D. pulchellum Wood. 4–12.

WK. In the plankton, Bracebridge and Blackroot Pools, Sutton Park; Berkswell. WS. Hawkesley Hall pond, King's Norton; Wilden Pool, near Stourport.

Var. *oviforme* (=*D. oviforme* Lagerh.). 4–6, 9.

WK. Bradnock's Marsh; Berkswell; Lapworth; Shirley. WS. Canal, Lifford; Warley.

WESTELLA De Wild.

W. botryoides De Wild. (=*Tetracoccus botryoides* W. West). 11.

WS. Pond at Stapenhall Farm, King's Norton.

PROTOCOCCACEÆ.

PROTOCOCCUS Ag.

P. viridis Ag. (=*Pleurococcus vulgaris* Auct.).

Abundant everywhere on trees, walls, stones, soil, etc.

P. rufescens Kütz. (=*Pleurococcus rufescens* Bréb.). 10.

WS. In a rain-water tank, Bewdley, making it blood-red.

TROCHISCIA Kütz.

T. aspera (Reinsch) Hansg. 4.

WK. In soils, Edgbaston, Harborne, Gravelly Hill, and Sutton Coldfield. In pools, Berkswell and Yardley. WS. In soils, California, Warley, and Northfield; in pond, Westhills. ST. In soils, West Bromwich, Sedgley, Himley, Baggeridge, and Tettenhall.

T. hirta (Reinsch) Hansg.

WK. In soils, Edgbaston. WS. In soils, California.

T. reticularis (Reinsch) Hansg. 4.

WS. [Hunnington, *W. J. H.*]

CHLORELLA Beij.

C. vulgaris Beij.

Frequent: found also in symbiosis in *Hydra viridis*, *Stentor*, *Paramœcium*, and *Ophrydium.* These symbiotic forms are often called *Zoochlorella*.

C. miniata (Kütz.) Wille.

Found occasionally in greenhouses on plant-pots.

AUTOSPORACEÆ.

OOCYSTIS Näg.

O. solitaria Wittr. 2, 5, 7, 8, 10, 11.

WK. Bracebridge Pool, Sutton Park; Studley. WS. Hawkesley Hall and Stapenhall Farm ponds, King's Norton, Kidderminster.

O. lacustris Chod. 6, 9, 10.

WK. In the plankton, Bracebridge Pool, Sutton Park.

O. parva W. & G. S. West. 8, 9.

WS. Canal, Lifford; Kidderminster.

O. elliptica W. West. 10.

WS. Pond near Hawkesley Hall, King's Norton.

NEPHROCYTIUM Näg.

N. Agardhianum Näg. 7, 8.

WK. Longmoor Pool, Sutton Park. WS. King's Norton.

EREMOSPHÆRA De Bary.

E. viridis De Bary. 1-12.

WK. In Bogs I and III, and in Bracebridge and Longmoor Pools, Sutton Park. WS. Hartlebury Common.

MICRACTINIUM Fres.

M. pusillum Fres. (=*Richteriella botryoides* Lemm.). 6, 7, 9.

WS. Pond at Stapenhall Farm, *W. J. H.* Canal, Lifford. See Journ. Bot. 1911, p. 84.

M. radiatum (Chod.) Wille (=*Golenkinia radiata* Chod.). 6.

WS. [Pond at Stapenhall Farm, King's Norton, *W. J. H.*]

LAGERHEIMIA Chod.

L. genevensis Chod. 5, 8–10.

WS. King's Norton; in the plankton, Blackroot Pool, Sutton Park. ST. Great Barr Park. See West, Journ. Bot. 1911, p. 85, fig. 2, A.

Var. *subglobosa* (Lemm.) Chod. 4, 10.

WK. Studley, in a small pool; in the plankton, Bracebridge Pool, Sutton Park. See West, *l. c.* p. 85, fig. 2.

L. wratislaviensis Schröd. 5, 10.

WK. Studley. First British record; see West, Journ. Bot. 1911, p. 85, fig. 2, G. WS. King's Norton.

CHODATELLA Lemm.

C. quadriseta Lemm. 10.

WK. Studley.

C. ciliata Lag. (=*Lagerheimia ciliata* Chod.). 7, 8.

WS. [Canal, Lifford, *W. J. H.*]

TETRAEDRON Kütz.

T. muticum (A. Br.) Hansg. 6.

WK. Botanic Gardens, Edgbaston.

T. tetragonum (Näg.) Hansg. 6–10.

WK. Bradnock's Marsh; Berkswell; Shirley; Studley. WS. Canal, Lifford; King's Norton; Kidderminster. ST. Great Barr Park.

T. minimum (A. Br.) Hansg. 6–11.

WK. In the plankton, Bracebridge, Blackroot, and Powell's Pools, Sutton Park; Berkswell; Shirley; Yardley; Olton; Studley. WS. King's Norton; Shanklin Pool, Kidderminster.

T. caudatum (Cord.) Hansg. 6, 8, 10.

WK. Windley and other pools, Sutton Park. WS. King's Norton; pools near Kidderminster. There is also a record from Tewkesbury.

T. regulare Kütz. 5, 8, 10.

WK. In the plankton, Bracebridge Pool; Lapworth, etc. WK. King's Norton; Kidderminster.

T. enorme (Ralfs) Hansg. 8, 9.

WS. [King's Norton, *W. J. H.*]

T. limneticum Borge. 5–10.

WK. In the plankton, Bracebridge, Blackroot, Powell's and Windley Pools, Sutton Park.

T. horridum W. & G. S. West.

WK. Nuneaton, abundant.

T. hastatum (Rabenh.) Hansg. 6.

WK. Earlswood.

CERASTERIAS Reinsch.

C. raphidioides Reinsch. 7.

WK. Berkswell; a remarkable species.

ANKISTRODESMUS Corda.

A. falcatus (Corda) Ralfs. 2–11.

Common and generally distributed.

Var. *acicularis* (A. Br.) G. S. W.

WK. Common. Bracebridge Pool, Sutton Park, Earlswood, etc. WS. King's Norton; Barnt Green; Quinton, etc. See Journ. Bot. 1911, p. 86, fig. 3.

Var. *spirilliformis* (W. & G. S. W.) G. S. W.

WK. Botanic Gardens, Edgbaston; Bradnock's Marsh; Lapworth; Studley. WS. Canal, Lifford; King's Norton; Harvington Hall. ST. Great Barr Park.

Var. *mirabilis* G. S. W. 5.

WK. Lapworth.

Var. *terrestris* Bristol, in Annal. Bot. 1920, xxxiv. 49, f. 2.

WS. In soil, Warley.

A. Pfitzeri (Schröd.) G. S. West. 7, 8, 10.

WK. In the plankton, Bracebridge and Blackroot Pools, Sutton Park.

A. Spirotænia G. S. West in Journ. Bot. 1911, p. 86, fig. 3. 10.

WS. Canal, Lifford. [In the same canal a form assigned to *A. setigerus* (Schröd.) West, in July, *W. J. H.*]

SELENASTRUM Reinsch.

S. acuminatum Lagerh. 2–5, 9.

WK. Olton. See West, Journ. Bot. 1912, p. 88, fig. 5. WS. Canal, Lifford.

S. gracile Reinsch. 2, 7, 10.

WK. Longmoor Pool, Sutton Park. WS. Pond at Stapenhall Farm, King's Norton.

ACTINASTRUM Lagerh.

A. Hantzschii Lagerh. 7, 9, 10.

WS. Canal, Lifford. ST. Great Barr Park.

KIRCHNERIELLA Schmidle.

K. obesa (West) Schmidle. 5–12.

WK. In the plankton, Bracebridge Pool, Sutton Park. WS. King's Norton.

K. subsolitaria G. S. West. 10.

WK. Studley,

K. lunaris (Kirchn.) Möb.

WK. In plankton, Bracebridge Pool, Sutton Park.

SCENEDESMUS Meyen.

S. bijugatus (Turp.) Kütz. 4–11.

Frequent and generally distributed.

f. *arcuatus* (Lemm.) W. & G. S. West. 6, 8, 10.

WK. In the plankton, Bracebridge Pool.

S. denticulatus Lagerh. 5.

WK. Lapworth.

Var. *linearis* Hansg. 5–12.

WK. Bracebridge, Longmoor, and Windley Pools, Sutton Park. WS. Pond near Hawkesley Hall, King's Norton; Kidderminster, etc.

S. quadricauda (Turp.) Bréb. 3–12.

Frequent and generally distributed.

Var. *abundans* Kirchn. 5, 6, 8, 10.

WK. Very abundant in the plankton, Bracebridge and Windley Pools, Sutton Park; Botanic Gardens, Edgbaston; Olton; Yardley; Shirley; Lapworth. ST. Great Barr Park.

Var. *horridus* Kirchn. 8.

WK. Windley Pool, Sutton Park.

Var. *opoliensis* (Richter) W. & G. S. West. 5, 6, 9.

WK. Bradnock's Marsh; Lapworth. WS. Canal, Lifford.

S. obliquus (Turp.) Kütz. 4–11.

Frequent in pools and ponds everywhere.

Var. *dimorphus* (Turp.) Rabenh. 5–7, 10.

WK. Yardley; Berkswell; Shirley; Lapworth.

S. antennatus Bréb. 9.

WS. Canal, Lifford.

S. Raciborskii Wolosz. 8.

WS. Wilden Pool, near Stourport.

S. acutiformis Schröd. 5, 10.

WS. Pond near Hawkesley Hall, King's Norton.

Var. *brasiliensis* (Bohlin) W. & G. S. West. 5, 6.

WK. In the plankton, Sutton Park; Olton Reservoir.

S. spicatus W. & G. S. West. 10.

ST. Great Barr Park.

DACTYLOCOCCUS Näg.

D. bicaudatus A. Br. 4.
WS. Warley.

CRUCIGENIA Morren.

C. apiculata (Lemm.) Schmidl. 6, 8.
WK. Windmill Pool, Shirley. WS. Wilden Pool, near Stourport. Very rare.

C. reniformis Griffiths, Journ. Linn. Soc., Bot. 1916, xliii. 431, pl. 34, fig. 14. 8.
WS. Wilden Pool, near Stourport.

C. rectangularis (Näg.) Gay. 6–10.
WK. In the plankton, Bracebridge Pool; Shirley. WS. Pools near Kidderminster.

TETRASTRUM Chod.

T. staurogeniiforme (Schröd.) Chod. 7.
WK. Berkswell. A remarkable species and very rare. WS. Upper Pool, Spring Grove, near Kidderminster.

CŒLASTRUM Näg.

C. sphæricum Näg. 1–12.
WK. Frequent. In all the pools, Sutton Park; Botanic Gardens, Edgbaston; Studley, etc. WS. Canal, Lifford; King's Norton; Wilden Pool, Stourport. ST. Great Barr Park; Himley Park.

C. cambricum Arch. 12.
WK. In the plankton, Bracebridge Pool. WS. Island Pool, near Stourport.

C. microporum Näg. 3, 5, 10.
WK. In the plankton, Sutton Park; Earlswood. Also recorded from near Tewkesbury.

C. reticulatum (Dang.) Senn. 7–10.
WK. In the plankton, Bracebridge Pool, Sutton Park. ST. Bearwood.

SORASTRUM Kütz.

S. spinulosum Näg. 7, 10.
WS. Pond at Stapenhall Farm, King's Norton.

CHÆTOPELTIDACEÆ.

CHÆTOSPHÆRIDIUM Klebahn.

C. globosum (Nordst.) Kleb. 2, 11.
WS. Pond at Stapenhall Farm, King's Norton.

PLANOSPORACEÆ.

CHLOROCOCCUM Fries.

C. humicola (Näg.) Rabenh.
Found everywhere in soil. See Bristol, Journ. Linn. Soc., Bot. 1919, xliv. 473, and Annal. Bot. 1920, xxxiv. 75.

CHLOROCHYTRIUM Cohn.

C. Lemnæ Cohn. 5.
WK. Henley-in-Arden; Harborne, *W. J. H.* WS. Barnt Green.

These are the only records made, but the species is really rather common wherever *Lemna trisulca* abounds.

C. paradoxum (Klebs) G. S. West.

WK. In soil, Sutton Coldfield. ST. In soil, Himley Park. See Bristol, Journ. Linn. Soc., Bot. xlv. 301, 1920.

C. Facciolæ (Borzi) Bristol. 10.

ST. Great Barr Park. See also Bristol, *l. c. supra.*

DICRANOCHÆTE Hieron.

D. reniformis Hieron var. *lævis* Hodgetts in New Phytol. 1916, xv. 108. 4.

WK. Harborne, in a small pond, epiphytic on *Ranunculus aquatilis*, etc.

[The small pond in which this alga has occurred regularly for the last five years dries up completely in the summer months, the alga perennating upon dead shrivelled leaves of *Callitriche*, etc., in a resting condition. In this state the gelatinous sheath of the cells is well developed, being thicker than in ordinary individuals growing under water; doubtless it is this thick gelatinous sheath which enables the alga to resist desiccation. These resting-cells possess *no seta*, or at any rate only the short fragmentary remains of the base of a seta. In other respects they are normal in appearance, and have a bright green chloroplast which is packed with minute starch-grains.—*W. J. H.*]

CHARACIUM A. Br.

C. Sieboldi A. Br. 2, 4, 10.

WK. Berkswell. WS. King's Norton; Quinton.

C. longipes A. Br. 4, 10, 11.

WS. Pond near Hawkesley Hall, King's Norton.

C. ornithocephalum A. Br. 5.

WK. Lapworth.

C. tenue Herm. 2, 5.

WK. Coleshill. WS. Moat at Harvington Hall.

C. Pringsheimii A. Br. 3.

WS. [King's Norton, *W. J. H.*]

HYDRODICTYACEÆ.

PEDIASTRUM Meyen.

P. Boryanum (Turp.) Menegh. 1–12.

Very common and generally distributed.

Var. *granulatum* Kütz. 5.

ST. No other record than Great Barr Park was made, but it is really almost as common as the type.

P. duplex Meyen. 1–12.

Common and generally distributed.

Var. *clathratum* A. Br. 4–12.

WK. In the plankton, Bracebridge and Blackroot Pools, Sutton Park; Olton Reservoir.

Var. *reticulatum* Lagerh. 5–12.

WK. In the plankton, Bracebridge Pool, Sutton Park. WS. Pond at Stapenhall Farm, King's Norton.

P. integrum Näg. 10.

This is recorded, among the notes, from near Tewkesbury.

P. Tetras (Ehrenb.) Ralfs. 5–11.

WK. In the plankton, Sutton Park; Shirley; Berkswell. WS. Canal, Lifford; King's Norton.

HYDRODICTYON Roth.

H. reticulatum (L.) Lagerh. 2.

WK. Blackroot Pool, etc., Sutton Park, in enormous numbers (1883), *A. W. Wills.* WS. Moseley Pool (1881). Very rare in the district. ST. Bourne Pool, near Aldridge (1882), *T. Bolton.*

SIPHONALES.

VAUCHERIACEÆ.

VAUCHERIA DC.

Many species, no doubt, are common, but the records refer only to those which were found in fruit.

V. sessilis (Vauch.) DC. 4–6, 9–12.

WK. Sutton Park; Solihull; Studley; Henley-in Arden. WS. Quinton; Barnt Green; Alvechurch. ST. Bearwood; Great Barr Park.

V. hamata (Vauch.) Lyngb. 10.

WK. Edgbaston; Studley.

V. terrestris Lyngb. 5, 12.

WK. Harborne; Edgbaston, etc. WS. Woodgate, etc.

V. geminata (Vauch.) DC. 3–5, 10.

WS. King's Norton; Quinton; Barnt Green.

Var. *racemosa* (Vauch.) Walz.

WK. [Pond at Harborne, *W. J. H.*]

V. aversa Hass. 1, 6, 10, 12.

WK. Harborne. WS. [Quinton; King's Norton, *W. J. H.*] ST. [Bearwood. A frequent species in many ponds during winter and early spring, and usually fruiting abundantly, *W. J. H.*]

SIPHONOCLADIALES.

CLADOPHORACEÆ.

CLADOPHORA Kütz.

C. glomerata (L.) Kütz. 2–7, 11.

Very common in running waters everywhere.

C. fracta Kütz. 4, 8.

WK. Stonebridge; Earlswood; Sheldon; Longmoor Pool; Wood End. WS. Barnt Green, floating in a pond. ST. Quarry House Pool, Hamstead.

C. crispata (Roth.) Kütz. 6–10.

WK. Yardley Wood; Lapworth; Studley. WS. Alvechurch; Hagley; Churchill. ST. Great Barr Park; Himley Park; Netherton. (Also Aston Botterel in Salop.)

CHÆTOMORPHA Kütz.

C. Linum (Müll.) Kütz. 5.

WK. Coleshill.

C. sutoria (Berk.) Rabenh. 6, 11.

WK. Rowton's Well, Sutton Park; near Yardley Wood. WS. Hagley.

RHIZOCLONIUM Kütz.

R. hieroglyphicum Kütz. 2–11.

Common and generally distributed.

Var. *riparium* (Harv.) Stockm. 12.

WS. Canal, Droitwich. A remarkable form.

ULVALES.

ULVACEÆ.

ENTEROMORPHA Harvey.

E. intestinalis (L.) Link. 7–10.

WK. In canals, Earlswood, Tardebigge, Whitacre, etc. WS. Pool on Hartlebury Common; Droitwich, etc. ST. Himley Park; Great Barr Park, etc.

E. percursa (Ag.) J. Ag., *non* Harv.

WS. [In a ditch near the canal at Salwarp, *W. J. H.* The water was brackish.]

MONOSTROMA Wittr.

M. bullosa (Roth) Wittr. 4.

WK. Solihull. Very rare.

SCHIZOGONIALES.

PRASIOLACEÆ.

PRASIOLA Ag.

P. crispa (Lightf.) Menegh.

Common everywhere, remarkably so in towns. It can be found in plenty on the flat grave-stones of St. Philip's Churchyard and elsewhere in the centre of Birmingham. The filamentous form (f. *muralis* G. S. W. = *Schizogonium murale* Kütz.) is more frequent than the foliaceous form, into which it at times develops. This typical form (foliaceous) sometimes occurs abundantly at the foot of old gateposts in the country, where there is a plentiful nitrogenous food-supply.

ULOTRICHALES.

ULOTRICHACEÆ.

GEMINELLA Turp.

G. interrupta Turp. 7, 8.

WS. Quinton; Island Pool, near Kidderminster. A rare species.

G. (*Hormospora*) *mutabilis* (Bréb.) Wille. 5.

WK. In a bog near Bracebridge Pool, Sutton Park. Rare.

ULOTHRIX Kütz.

U. subtilis Kütz. 5–7.

WK. Harborne, etc., but not so common as the variety. WS. West-hills. ST. Old Hill; Tettenhall.

Var. *variabilis* (Kütz.) Kirchn. 2–10.

Very abundant, in and on soil, in tanks, ditches, and all sorts of wet places. In rapidly-running water, Clent.

Var. *tenerrima* (Kütz.) Kirchn. 2–10.

WK. Bog II and Bracebridge Pool, Sutton Park. WS. King's Norton; Barnt Green.

U. zonata (Webb & Mohr) Kütz. 5.

WS. [Bromsgrove, in running water, *W. J. H.*]

U. æqualis Kütz. 5.

ST. Great Barr Park. The only record, but really rather common on damp ground.

U. tenuissima Kütz.

WK. In soil, Edgbaston.

U. spiroides G. S. West, Journ. Bot. 1915, p. 81, fig. 5. 10.

ST. Great Barr Park.

U. subconstricta G. S. West, *l. c.* p. 82, fig. 6. 2–4, 10.

ST. Pond at Stapenhall Farm, King's Norton, for several years.

STICHOCOCCUS Näg.

S. bacillaris Näg. 1–5.

WK. Frequent on damp soil and gravel paths, Edgbaston, etc. WS. Quinton; King's Norton. ST. Baggeridge.

S. flaccidus (Kütz.) Gay. 2.

WK. Studley.

S. nitens (Klebs) Bristol (= *Hormidium nitens* Menegh. emend. Klebs).

WK. In damp soil, Gravelly Hill. See Annal. Bot. 1920, xxxiv. 77.

S. scopulinus Hazen. 12.

WK. Studley. Previously known only from New York.

URONEMA Lagerh.

U. elongatum Hodgetts, New Phytol. 1918, xvii. 159. 2, 6.

WS. King's Norton. ST. Dudley Port.

MICROSPORACEÆ.

MICROSPORA Thur.

M. floccosa (Vauch.) Thur. 3–12.

Very common and generally distributed.

M. amœna (Kütz.) Lagerh. 3, 5, 6, 10,

WK. Bog III and Bracebridge Pool, Sutton Park; Shirley. WS. Wyre Forest.

M. pachyderma (Wille) Lagerh. 6.

WK. Botanic Gardens, Edgbaston, *W. J. H.*; Sutton Park. WS. King's Norton.

M. abbreviata (Rabenh.) Lagerh. 3, 5, 11.
WK. Bogs I and III and Bracebridge Pool, Sutton Park; Henley-in-Arden.

M. stagnorum (Kütz.) Lagerh. 4, 10, 11.
WK. In ditch, Sutton Park; Berkswell; Earlswood, etc. WS. King's Norton; Warley.

M. tumidula Hazen. 6.
ST. ? Manley Hall, Weeford (identified with doubt).

CYLINDROCAPSACEÆ.

CYLINDROCAPSA Reinsch.

C. geminella Wolle var. *minor* Hansg. 7, 10.
WK. Bracebridge Pool, Sutton Park. WS. King's Norton.

CHÆTOPHORACEÆ.

CHÆTOPHORA Schrank.

C. pisiformis (Roth) Ag. 4, 5.
WK. Berkswell; Coleshill; Whitacre. WS. Quinton, *W. J. H.* ST. Great Barr Park.

C. elegans (Roth) Ag. 5, 10.
WK. Bracebridge Pool, Sutton Park. WS. Clent, on shells of *Limnæa*.

C. tuberculosa (Roth) Ag. 5.
WS. Clent.

C. incrassata (Huds.) Hazen. (=*C. Cornu-Damæ* Ag.=*C. endiviæfolia* Ag.). 9, 10.
WK. Bracebridge and Keeper's Pools, Sutton Park; Hill Hook; Earlswood. WS. Wyre Forest.

DRAPARNALDIA Bory.

D. plumosa (Vauch.) Ag. 3, 4.
WK. Earlswood, etc., with resting spores. WS. Quinton. ST. Quarry House, Hamstead.

D. glomerata (Vauch.) Ag. 3, 4.
WK. Berkswell; Yardley. WS. Quinton.

STIGEOCLONIUM Kütz.

(=*Myxonema* Fr.)

S. tenue Ag. 3, 4, 6, 9.
Common and generally distributed.

S. lubricum Kütz. 7.
WK. Tanworth-in-Arden.

PROTODERMA Kütz.

P. viride Kütz. 5, 6.
WK. Not uncommon on all kinds of submerged parts of aquatic plants: *e.g.* Olton (on *Elodea*); Solihull (on *Vaucheria*); Harborne (on *Callitriche*), etc. WS. Equally common: *e.g.* King's Norton (on *Ranunculus*); Barnt Green (on *Myriophyllum*).

MICROTHAMNION Näg.

M. Kützingianum Näg. 4, 6, 7, 10.

WK. Longmoor Pool, Sutton Park; Berkswell; Earlswood. WS. Pond near Hawkesley Hall, King's Norton; Barnt Green.

M. strictissimum Rabenh. (=*M. vexator* Cooke). 2, 4–7.

WK. Bracebridge and other pools, Sutton Park; Harborne; Coleshill. WS. Hartlebury Common, *W. J. H.* ST. Bearwood.

GONGROSIRA Kütz.

G. terricola Bristol, Annal. Bot. 1920, xxxiv. 77, pl. ii.

ST. Baggeridge, in soil. Also found in Wilts and Northants.

G. Schmidlei Richter. 6.

WS. Randan Woods. See West in Journ. Bot. 1912, p. 329. First record in the British Isles.

ENDODERMA Lagerh.

E. Cladophoræ Hornby, New Phytol. 1918, p. 41. 6.

WK. In Rowton's Well, Sutton Park. [Described by its discoverer as occurring on *Cladophora* and *Rhizoclonium* only, but it has since been found, in the original locality, in the cell-wall of *Chætomorpha sutoria, W. J. H.*]

TRENTEPOHLIACEÆ.

TRENTEPOHLIA Mart.

T. aurea (L.) Mart. (=*Chroolepus aureus* Ag.). 8, 9.

WS. On rocks, Malvern Hills. ST. On trees, Baggeridge Woods.

APHANOCHÆTACEÆ.

APHANOCHÆTE A. Br.

A. repens A. Br. 2, 5, 6, 10.

Frequent: epiphytic on various filamentous algæ and other aquatic plants.

A. confervoides (Näg.) Rabenh. 5, 6, 10.

WK. Bracebridge Pool, Sutton Park; Coleshill; Berkswell; Lapworth (on *Spirogyra crassa*).

A. pilosissima (Schmidl.) G. S. West. 1, 5.

WK. Bog II and Bracebridge Pool, Sutton Park.

COLEOCHÆTACEÆ.

COLEOCHÆTE Bréb.

C. scutata Bréb. 1, 4–6, 11.

WK. Bracebridge Pool, Sutton Park; Yardley, on *Potamogeton*; Olton; Berkswell; Henley-in-Arden. WS. King's Norton, in fruit; Barnt Green; Trimpley.

C. irregularis Pringsh. 4.

WK. Yardley. WS. King's Norton.

C. Nitellarum Jost. 5–7.

WK. Berkswell, *W. J. H.* In pond at Sutton Coldfield, and in

Bracebridge Pool, Sutton Park, both on *Nitella flexilis*. WS. King's Norton, in fruit.

Previously recorded only from Glasgow.

AKONTÆ.

CONJUGATÆ.

ZYGNEMACEÆ.

MOUGEOTIA Ag.

M. scalaris Hass. 1–6, 9–12.

WK. Bog II, Sutton Park; Bracebridge Pool; Solihull; Whitacre, etc. WS. Barnt Green; Clent; Warstock; Wyre Forest; King's Norton (in conjugation). ST. Bearwood (in conjugation).

This species is one of the first algæ to appear in plenty when the season opens.

M. parvula Hass. 1, 5, 6, 10.

WK. Bogs I and II and Bracebridge Pool, Sutton Park (in fruit).

M. genuflexa (Dillw.) Ag. (= *M. mirabilis* Wittr.). 3, 4, 10.

WK. Bog II, Sutton Park. ST. Himley Park.

M. viridis (Kütz.) Wittr. 2–5.

WK. Bog II, Sutton Park; in ditch, Bracebridge Pool; Harborne. WS. Warley; Hartlebury Common. ST. Bearwood. In conjugation in all these places.

M. gracillima (Hass.) Wittr. 4, 5.

WK. In a ditch, Sutton Park (fruiting in April).

M. capucina (Bory) Ag. 5.

WS. Barnt Green.

ZYGNEMA Ag.

Z. ericetorum (Kütz.) Hansg. 2, 3, 7, 9.

WK. Earlswood. WS. King's Norton; Hartlebury Common; Wyre Forest, in conjugation! See Hodgetts in New Phytol. 1918, xvii. 238.

Z. stellinum (Vauch.) Ag. 5, 6.

WK. [Upper Bracebridge Pool, abundant in conjugation, *W. J. H.*]

Several other species of *Zygnema* and *Mougeotia* have been found, but not in conjugation.

SPIROGYRA Link.

S. longata Cram. & Br. 5, 10.

WK. Bog II, Sutton Park; Solihull. WS. King's Norton (in conjugation).

S. porticalis (Vauch.) Cleve. 5.

ST. [Bearwood, *W. J. H.*]

S. Jürgensii Kütz. 5.

WS. Pool near Hawkesley Hall, King's Norton (in conjugation).

S. cateniformis (Hass.) Kütz. (= *S. arcta* Kütz. var. *cateniformis* Kirchn.). 5.

WS. [King's Norton, in conjugation, *W. J. H.*]

S. varians (Hass.) Kütz. 5.

ws. Quinton; Clent; Barnt Green. st. Bearwood. All in conjugation.

S. communis (Hass.) Kütz. 5.

wk. Coleshill (in conjugation). ws. Barnt Green. st. Bearwood (in conjugation).

S. condensata Kütz. 5.

ws. King's Norton (in conjugation).

S. nitida (Dillw.) Link. 1, 5, 7, 10.

wk. Bog II, Sutton Park; Bracebridge; Berkswell. ws. Barnt Green; near Hawkesley Hall, King's Norton (in conjugation).

S. majuscula Kütz. 5, 11.

wk. Berkswell. ws. King's Norton.

S. maxima Wittr. 5.

ws. King's Norton (in conjugation).

S. crassa Kütz. 4, 5.

wk. Lapworth (in conjugation). ws. Barnt Green.

S. mirabilis (Hass.) Petit. 5, 8.

wk. Berkswell (in conjugation). ws. King's Norton (in conjugation).

S. gracilis (Hass.) Kütz. 3.

wk. Pond near Hawkesley Hall, King's Norton (in conjugation).

S. tenuissima (Hass.) Kütz. 3–5.

wk. Bracebridge; Solihull; Harborne. ws. Halesowen; King's Norton; Quinton. Frequently conjugating.

S. inflata (Vauch.) Rabenh. 5, 11.

wk. Berkswell. ws. King's Norton, etc. (both in conjugation).

S. quadrata Petit. 5.

wk. Solihull.

S. Weberi Kütz. 6.

ws. Halesowen (sterile, and therefore doubtful); Hawkesley Hall Farm, King's Norton (in conjugation).

S. Grevilleana (Hass.) Kütz. 6.

ws. King's Norton; Clent (both in conjugation).

S. Hassallii Jenn. 5.

ws. Clent; Barnt Green.

S. calospora Cleve. 5.

ws. King's Norton (in conjugation).

S. pellucida (Hass.?) Kütz. 10.

wk. Bog II, Sutton Park.

S. colligata Hodgetts in Annal. Bot. 1920, xxxiv. Oct. 1–6, 12.

ws. Pond near Hawkesley Hall Farm, King's Norton (in conjugation). The only known locality for this remarkable Conjugate, which forms its zygospores according to three different methods—scalariform, lateral, and terminal; it also has remarkable **H**-shaped pieces of membrane connecting together and, as it were, *clamping* the cells at their junctions.

In Hawkesley Hall Farm pond, eleven species of *Spirogyra* were found simultaneously in conjugation in May 1919, viz. *S. calospora, S. cateniformis, S. colligata, S. condensata, S. inflata, S. Jür-*

gensii, *S. longata*, *S. maxima*, *S. mirabilis*, *S. nitida*, and *S. Weberi*—six of these and *S. Grevilleana* were again found in conjugation in May, 1920, *W. J. H.*

DESMIDIACEÆ.

Saccodermeæ.

GONATOZYGON De Bary.

G. Monotænium De By. 10.

WK. Sutton Park.

G. Brebissonii De By. 2, 5–7, 10, 11.

WK. Longmore Pool, Sutton Park; Botanic Gardens, Edgbaston. WS. Pond at Stapenhall Farm, King's Norton; Halesowen.

G. Kinahani (Arch.) Rabenh. 2–4, 9, 10.

WK. Sutton Park; Earlswood. WS. Pond at Stapenhall Farm, King's Norton; Wyre Forest.

SPIROTÆNIA Bréb.

S. condensata Bréb. 5, 7, 12.

WK. Longmoor Pool, etc., Sutton Park; Lapworth.

S. obscura Ralfs. 1, 7.

WK. Bracebridge and Longmoor Pools, Sutton Park.

S. endospira (Kütz.) Arch.

WS. [Wyre Forest, *W. J. H.*]

CYLINDROCYSTIS Menegh.

C. Brebissonii Menegh. 1–12.

WK. Longmoor Pool; Edgbaston; Harborne; Earlswood. WS. Quinton; Warley; Hartlebury Common, in conjugation. ST. Bearwood, in conjugation.

Var. *minor* W. & G. S. West. 4.

WK. Earlswood.

C. crassa De By. 7, 10.

WK. Sutton Park.

NETRIUM Näg.

N. Digitus (Ehrenb.) Itzig. & Roth. 1–12.

WK. Bogs I, II, and III, and Longmoor Pool, Sutton Park. ST. Bearwood, *W. J. H.*

N. Nägelii (Bréb.) W. & G. S. West.

WK. Sutton Park, *A. W. Wills.*

N. oblongum (De By.) Lütkem. 3, 5.

WK. Bog III, Sutton Park.

Var. *cylindricum* W. & G. S. West. 2, 3, 6.

WK. Sutton Park. WS. Warley.

N. interruptum (Bréb.) Lütkem.

WK. Sutton Park, *A. W. Wills.*

MESOTÆNIUM Näg.

M. chlamydosporum De By. 3, 4.

WK. Harborne; Earlswood.

M. caldariorum (Lagerh.) Hansg. 6, 9.

WS. Wyre Forest, on damp ground. See West, Journ. Bot. 1915, p. 78, figs. 3, 4.

M. Endlicherianum Näg. 3.

WK. Harborne, *W. J. H.* WS. Warley.

ROYA W. & G. S. West.

R. cambrica W. & G. S. West. 3, 4.

WS. Warley; Quinton. ST. Bearwood, fine specimens, *W. J. H.*

R. anglica G. S. West. 3, 4.

WS. Quinton, in conjugation. See Hodgetts, Journ. Bot. 1920, pp. 65–9.

Placodermeæ.

PENIUM Bréb.

P. Jenneri Ralfs.

WK. Sutton Park, *A. W. Wills.*

P. truncatum Bréb. 6.

WK. Sutton Park.

P. margaritaceum (Ehr.) Bréb.

WK. Sutton Park, *A. W. Wills & T. Bolton.*

P. Cylindrus (Ehrenb.) Bréb. 1–3, 6, 10–12.

WK. Bog I, Sutton Park.

P. spirostriolatum Barker. 2–4, 6, 10, 11.

WK. Bogs I and II, Sutton Park.

P. polymorphum Perty. 5.

WK. Bog I, Sutton Park.

CLOSTERIUM Nitzsch.

Cl. Libellula (Focke) Lütkem. 1–12.

WK. Bogs I and II, and Bracebridge Pool, Sutton Park.

Var. *interruptum* W. & G. S. West. 6.

WK. Bog III, Sutton Park.

Cl. Navicula (Bréb.) Lütkem. 3, 6, 7.

WK. Bog I, Sutton Park. WS. King's Norton, *W. J. H.*

Cl. Cynthia De Not. 1–12.

WK. Bogs I and II, Sutton Park.

Cl. didymotocum Cord. 10, 11.

WK. Bog I, Sutton Park.

Cl. angustatum Kütz. 6.

WK. Bog I, Sutton Park.

Cl. costatum Cord. 1–12.

WK. Bogs I and III, and Bracebridge Pool, Sutton Park. WS. King's Norton; Warley.

Cl. regulare Bréb. 4, 5, 7.

WK. Bog I, Sutton Park. WS. Pond at Hawkesley Hall, King's Norton.

Cl. striolatum Ehrenb. 1–12.

WK. Bogs I and II, and Bracebridge and Longmoor Pools, Sutton Park; Knowle; Berkswell. WS. King's Norton; Warley; Trimpley. ST. Himley Park.

Cl. intermedium Ralfs. 1–12.

WK. Bogs I and III, Sutton Park.

Var. *hibernicum* West.

WK. Sutton Park.

Cl. Ulna Focke. 5, 6, 11.

WK. Bog I, Sutton Park (very rare). WS. Quinton, *W. J. H.*

Cl. juncidum Ralfs. 1–12.

WK. Bog I, Sutton Park. WS. King's Norton, *W. J. H.*

Cl. Dianæ Ehrenb. 1–12.

WK. Bracebridge Pool, etc., Sutton Park; Earlswood. WS. Pond at Hawkesley Hall, King's Norton; Warley; Canal, Lifford; Hunnington, in conjugation; Quinton. ST. Bearwood.

Cl. parvulum Näg. 1–12.

WK. Bogs I, II, and III, and Bracebridge Pool, Sutton Park; Berkswell; Earlswood, in conjugation. WS. Warley. ST. Bearwood; Himley Park.

Cl. Jenneri Ralfs. 1–3, 6, 7.

WK. Bogs I and III, and Bracebridge and Longmoor Pools, Sutton Park. WS. Quinton, *W. J. H.*

Cl. Venus Kütz. 1–12.

WK. Bogs I, II, III, and Bracebridge and Longmoor Pools, Sutton Park; Bradnock's Marsh; Berkswell; Shirley; Olton. WS. Ponds at Stapenhall and Hawkesley Hall Farms, King's Norton; Quinton. ST. Bearwood.

Cl. Leibleinii Kütz. 1–12.

WK. Frequent. Sutton Park; Earlswood, etc., etc. WS. King's Norton; Halesowen; Trimpley; Harvington Hall; Churchill; Wyre Forest, etc. ST. Himley Park.

Cl. moniliferum (Bory) Ehrenb. 1–12.

WK. Common. Sutton Park; Earlswood; Olton, etc., etc. WS. Frequent. King's Norton; Barnt Green; Hagley, etc. ST. Great Barr Park.

Cl. Ehrenbergii Menegh. 3–6, 10.

WK. Bracebridge Pool, Sutton Park; Yardley, with zygotes; Bradnock's Marsh; Lapworth; Shirley. WS. King's Norton; Warley; Quinton; Wyre Forest. ST. Bearwood, in conjugation, *W. J. H.*

Cl. acerosum (Schrank) Ehrenb. 3–11.

WK. Frequent. Sutton Park; Berkswell; Earlswood, etc., etc. WS. King's Norton, in conjugation; Canal, Lifford; Hagley; Quinton (in conjugation, May, zygospores very abundant); Clent; Harvington Hall: Wyre Forest. ST. Great Barr Park.

Var. *elongatum* Bréb. 7.

WK. Bracebridge Pool, Sutton Park. WS. King's Norton, *W. J. H.*

Cl. lanceolatum Kütz. 4–6.

WK. Henley-in-Arden; Berkswell; Solihull; Sutton Park, etc. WS. Near Harborne; King's Norton, in conjugation. ST. Bearwood, in conjugation.

Cl. Lunula (Müll.) Nitzsch. 1–12.

WK. Bogs I and II, and Bracebridge Pool, Sutton Park; Harborne. WS. King's Norton.

Cl. peracerosum Gay. 5, 6.

WK. Lapworth; Windmill Pool, Shirley. WS. Halesowen, very abundant; King's Norton.

Var. *elegans* G. S. West. 6.

WK. Bradnock's Marsh.

Cl. littorale Gay. 4.

WK. Harborne, *W. J. H.*

Cl. tumidum Johns. 3.

WK. Earlswood, in conjugation, var. *sphærospora* West, Journ. Bot. 1911, p. 84, fig. 1; Harborne, *W. J. H.*

Cl. Cornu Ehrenb. 3, 5, 8, 9.

WK. Sutton Park. WS. Warley; Halesowen; Spring Grove, near Kidderminster. ST. Bearwood.

Cl. abruptum West. 3–7, 10–12.

WK. Bog I, Sutton Park. WS. Warley. ST. Bearwood.

Cl. pusillum Hantzsch. 4.

WK. Earlswood, typical and very abundant.

Cl. prælongum Bréb. 3, 5, 9–11.

WK. Bracebridge Pool, Sutton Park; Berkswell; Studley. WS. Canal, Lifford; King's Norton.

Var. *brevius* West. 3, 4, 6.

WK. Bracebridge Pool, Sutton Park; Berkswell, in conjugation.

Cl. gracile Bréb. 5, 10.

WK. Bogs I and III, Sutton Park; Berkswell.

Cl. attenuatum Ehrenb. 10.

WK. Sutton Park, *A. W. Wills*; Berkswell.

Cl. turgidum Ehrenb. 11, 12.

WK. Bog II, Sutton Park.

Cl. Pritchardianum Arch. 3, 9.

WK. Bracebridge Pool, Sutton Park. WS. King's Norton, *W. J. H.*

Cl. pronum Bréb. 5, 9.

WK. Sutton Park. WS. King's Norton; pond near Hawkesley Hall; Wyre Forest.

Cl. aciculare Tuffen West. 5.

WS. Halesowen, typical.

Cl. acutum Bréb. 1–12.

WK. Bracebridge Pool, and Bogs I and III, Sutton Park; Berkswell; Earlswood. WS. Warley; King's Norton; pond near Hawkesley Hall. ST. Bearwood.

Cl. lineatum Ehrenb. 1–12.

WK. Bogs II and III, Sutton Park.

Cl. Kützingii Bréb. 4, 5, 8, 10.

WK. Bracebridge Pool and Bog I, Sutton Park; Berkswell; Knowle. WS. Quinton; King's Norton; pool near Hawkesley Hall.

Cl. rostratum Ehrenb. 2–12.

WK. Bracebridge and Longmoor Pools, and Bogs I, II, and III, Sutton Park; Harborne; Earlswood; Solihull. WS. Hunnington and Quinton, both in conjugation. ST. Bearwood, in conjugation; Great Barr Park; Manley Hall, Weeford.

Var. *brevispinum* West. 3, 4, 6.

WK. Sutton Park. WS. Warley. ST. Bearwood, in conjugation, *W. J. H.*

Cl. setaceum Ehr.

WK. Sutton Park, *A. W. Wills.*

PLEUROTÆNIUM Näg.

P. truncatum (Bréb.) Näg. 3–5, 7, 12.

WK. Longmoor Pool and Bog II, Sutton Park.

P. Ehrenbergii (Bréb.) De By. 2, 4–7, 11.

WK. Bracebridge Pool, Sutton Park; Shirley. WS. Stapenhall and Hawkesley Hall Farms, King's Norton.

P. Trabecula (Ehrenb.) Näg. 1–12.

WK. Bracebridge Pool, Sutton Park; Harborne; Shirley; Berkswell; Yarley; Olton. WS. Stapenhall and Hawkesley Hall Farms, King's Norton; Trimpley, etc. ST. Great Barr Park.

Var. *clavatum* (Kütz.) W. & G. S. West. 10.

WK. Bracebridge Pool, Sutton Park.

P. nodosum (Bail) Lund. 7.

WK. Bog II, Sutton Park.

TETMEMORUS Ralfs.

T. Brebissonii (Menegh.) Ralfs. 3, 10.

WK. Sutton Park. WS. King's Norton, *W. J. H.*; Hartlebury Common.

T. granulatus (Bréb.) Ralfs. 1–12.

WK. Bracebridge and Longmoor Pools, and Bogs I and III, Sutton Park. WS. King's Norton, *W. J. H.*; Hartlebury Common.

T. lævis (Kütz.) Ralfs. 2–11.

WK. Bogs I and III, Sutton Park. ST. Bearwood, *W. J. H.*

EUASTRUM Ehrenb.

E. oblongum (Grev.) Ralfs. 3–12.

WK. Bracebridge and Longmoor Pools, and Bogs I and III, Sutton Park. WS. King's Norton, etc.

E. Didelta (Turp.) Ralfs. 1–12.

WK. Bogs I and II, Sutton Park. WS. Hartlebury Common.

E. affine Ralfs. 10.

WK. Bog I, Sutton Park.

E. ansatum. 1–12.

WK. Bogs I and III, Sutton Park.

E. rostratum Ralfs.

WK. Sutton Park, *A. W. Wills.*

E. bidentatum Näg. 1–12.

WK. Longmoor Pool, and Bogs I and III, Sutton Park; Berkswell.

E. dubium Näg. 2, 7.

WK. Bog III, and Longmoor Pool, Sutton Park.

E. elegans (Bréb.) Kütz.

WK. Sutton Park, *A. W. Wills.*

E. binale (Turp.) Ehrenb. 3, 11.

WK. Bog II, Sutton Park (forma). WS. Hartlebury Common.

Var. *Gutwinskii* Schmidl. 1–11.

WK. Bogs I and III, Sutton Park.

Var. *sectum* Turn. 10.

WK. Bog I, Sutton Park.

E. pectinatum Bréb. 2–11.

WK. Bogs I and III, Sutton Park.

E. verrucosum Ehrenb. 7, 11.

WK. Bracebridge Pool, Sutton Park.

Vars. *alatum* Wolle and *reductum* Nordst. 7.

WK. Longmoor Pool, Sutton Park.

MICRASTERIAS Ag.

M. truncata (Cord.) Bréb. 1–12.

WK. Bracebridge and Longmoor Pools, and Bogs I and III, Sutton Park.

M. crenata Bréb.

WK. Sutton Park, *A. W. Wills.*

M. Jenneri Ralfs.

WK. Sutton Park, *A. W. Wills.*

M. apiculata (Ehrenb.) Menegh.

Var. *fimbriata* (Ralfs) Nordst.

WK. Sutton Park, *A. W. Wills.*

M. papillifera Bréb. 7.

WK. Longmoor Pool, Sutton Park.

Var. *varvicensis* Turn.

WK. Sutton Park, *T. Bolton.*

M. rotata (Grev.) Ralfs. 1–12.

WK. Bracebridge and Longmoor Pools, and Bogs I and II, Sutton Park.

M. denticulata Bréb. 1–12.

WK. Bracebridge and Longmoor Pools, and Bogs I and III, Sutton Park.

Var. *angulosa* (Hantzsch.) W. & G. S. West. 6.

WK. Bog I, Sutton Park.

M. Crux-melitensis (Ehrenb.) Hass. 7.

WK. Longmoor Pool, Sutton Park.

M. americana (Ehr.) Ralfs.

WK. Sutton Park.

COSMARIUM Corda.

C. curtum (Bréb.) Ralfs. 3, 10.

WK. Sutton Park, in rainwater pool by the roadside; Studley and Earlswood, on damp ground.

C. cucurbitinum (Biss.) Lütkem. 4.

WS. Quinton.

C. cruciferum De By. (=*Penium cruciferum* Wittr.). 4.

WK. Harborne. WS. Warley. ST. Bearwood.

C. pachydermum Lund. 7, 9.

WK. Longmoor Pool and Bog II, Sutton Park.

C. Ralfsii Bréb. 3.

WK. Sutton Park, *A. W. Wills.* WS. Hartlebury Common.

C. Cucumis (Cord.) Ralfs. 7.

WK. Longmoor Pool, Sutton Park.

C. subcucumis Schmidl. 2, 4, 11.

WK. Earlswood. WS. Stapenhall Farm, King's Norton.

C. undulatum Cord. 2, 11.

WK. Sutton Park, *A. W. Wills.* WS. Stapenhall Farm, King's Norton.

C. bioculatum Bréb. 2, 4–7.

WK. Botanical Gardens, Edgbaston; Sutton Park. WS. Halesowen; Stapenhall Farm, King's Norton.

Var. *hians* W. & G. S. West. 2.

WS. Stapenhall Farm, King's Norton.

C. tinctum Ralfs. 7.

WK. Longmoor Pool and Bog I, Sutton Park.

C. contractum Kirchn. 1.

WK. Bracebridge Pool, Sutton Park.

C. pyramidatum Bréb.

WK. Sutton Park, *A. W. Wills.*

C. pseudopyramidatum Lund.

WK. Sutton Park, *A. W. Wills.*

C. depressum (Näg.) Lund. 6, 11.

WK. Plankton of Bracebridge Pool, Sutton Park. WS. King's Norton.

C. granatum Bréb. 1, 5–8, 10, 11.

WK. Plankton of Bracebridge Pool, Sutton Park. WS. Trimpley; Kidderminster. Also near Tewkesbury in Gloucestershire.

Var. *subgranatum* Nordst. 2, 4–7, 10.

WK. Bog II, Sutton Park; Coleshill; Yardley; Shirley; Berkswell. WS. Stapenhall Farm, King's Norton. ST. Great Barr Park; Himley Park; Quarry House, Hamstead.

C. cymatopleurum Nordst.

Var. *tyrolicum* Nordst. 2, 9.

WK. Bog II, Sutton Park.

C. notabile Bréb. 4, 10.

WS. Quinton. ST. Great Barr Park.

C. subarctoüm (Lagerh.) Racib. 4.

WS. Warley. ST. Bearwood.

C. pseudarctoüm Nordst. 4.

ST. Bearwood.

C. arctoüm Nordst. 4.

WS. Warley.

C. Regnesi Reinsch. 4, 10, 11.

WK. Berkswell; Harborne. WS. Pond at Stapenhall Farm, King's Norton.

Var. *montanum* Schmidl. 7, 11.

WS. Pond at Stapenhall Farm, King's Norton.

C. quadratum Ralfs. 1, 3, 5–7, 9.

WK. Longmoor Pool and Bogs I and II, Sutton Park; Lapworth. WS. King's Norton; Trimpley.

C. pygmæum Arch. 8.

WK. Blackroot Pool, Sutton Park.

C. abbreviatum Racib. 6.

WK. Olton.

Var. *planctonicum* W. & G. S. West. 9.

WK. Sutton Park.

C. impressulum Elfv. 1, 4–6, 11.

WK. Bracebridge Pool, Sutton Park; Olton. WS. Pond at Hawkesley Hall Farm, King's Norton; Trimpley.

C. Regnellii Wille. 2, 11.

WS. Stapenhall Farm, King's Norton.

C. Meneghinii Bréb. 6–10.

WK. Bracebridge Pool, Sutton Park; Olton; Studley. WS. Stapenhall Farm, King's Norton; Stourport.

f. *latiusculum* Jacobs. 7.

WK. Bog II, Sutton Park.

C. angulosum Bréb. 2, 6, 10.

WK. Bracebridge Pool, Sutton Park. WS. Ponds at Hawkesley Hall and Stapenhall Farms, King's Norton.

Var. *concinnum* (Rabenh.) W. & G. S. West. 5, 6.

WK. Berkswell; Olton.

C. læve Rabenh.

Var. *octangulare* (Wille) W. & G. S. West. 10.

WK. Studley.

C. Thwaitesii Ralfs. 6.

WS. [Quinton, *W. J. H.*]

C. Cucurbita Bréb. 1, 3–12.

WK. Bogs I and III, Sutton Park. WS. Trimpley.

C. quadratulum (Gay) De Toni. 10.

WK. Sutton Park.

C. cælatum Ralfs. 10.

WK. Bog II, Sutton Park.

C. dentiferum Cord. 6, 9, 10–12.

WK. Sutton Park.

C. Brebissonii Menegh. 7.

WK. Longmoor Pool, Sutton Park.

C. reniforme (Ralfs.) Arch. 4–6, 10, 11.

WK. Sutton Park. WS. King's Norton; Halesowen; Stourport.

C. protractum (Näg.) De By. 6–8, 10.

WS. Sutton Park.

C. Sportella Bréb.

Var. *subnudum* W. & G. S. West. 7.

WK. Longmoor Pool, Sutton Park.

C. Turpinii Bréb. 5, 6, 8–11.

WK. Plankton of Bracebridge Pool, Sutton Park; Shirley; Olton; Yardley.

Var. *podolicum* Gutw. 10.

WK. Sutton Park.

Var. *eximium* G. S. W. 10.

Near Tewkesbury, Gloucestershire.

C. didymoprotupsum W. & G. S. West.

WK. Bracebridge Pool, Sutton Park.

C. præmorsum Bréb. 2–4, 7, 10, 11.

WK. Longmoor Pool, Sutton Park; Earlswood; Henley-in-Arden. WS. Hawkesley Hall and Stapenhall Farms, King's Norton; Halesowen; Barnt Green. ST. Great Barr Park.

C. margaritiferum Menegh.

WK. Sutton Park.

C. punctulatum Bréb. 4, 5, 7, 9–11.

WK. Bracebridge Pool, Sutton Park; Berkswell; Lapworth; Shirley; Studley.

C. bipunctatum Börg. 1.

WK. Trimpley.

C. humile (Gay) Nordst. 9–11.

WK. Bracebridge Pool, Sutton Park. WS. Hawkesley Hall Farm, King's Norton. ST. Himley Park.

C. subcrenatum Hantzsch. 2–6, 10.

WK. Bracebridge Pool, Sutton Park; Earlswood; Berkswell. WS. Pond at Stapenhall Farm, King's Norton; Clent, in boggy ditch. ST. Great Barr Park.

C. tumens Nordst. 4.

WS. Quinton—very rare.

C. subprotumidum Nordst. 2, 7, 10, 11.

WK. Bracebridge Pool, Sutton Park. WS. Stapenhall Farm, King's Norton.

Var. *Gregorii* (R. & B.) W. & G. S. West. 6.

WK. Olton. WS. King's Norton.

C. Bœckii Wille. 2, 6, 7, 9–12.

WK. Bracebridge and Longmoor Pools, Sutton Park. WS. Stapenhall Farm, King's Norton.

C. subcostatum Nordst. 7.

WK. Longmoor Pool, Sutton Park.

f. *minus* W. & G. S. West. 6

WK. Olton.

C. formosulum Hoff. 2, 4–7, 9.

WK. Longmoor and Bracebridge Pools, Sutton Park; Berkswell; Olton; Studley; Harborne. WS. Quinton, *W. J. H.*; Stapenhall Farm, King's Norton.

Var. *Nathorstii* (Boldt) W. & G. S. West.

WK. Sutton Park.

C. speciosum Lund. 4, 7, 9.

WK. In a ditch, Sutton Park. WS. Quinton; Wyre Forest.

C. subalatum W. & G. S. West. 8, 11.

WS. King's Norton.

C. tetraophthalmum Bréb. 7.

WK. Longmoor Pool, Sutton Park.

C. Botrytis Menegh. 1–11.

Common and generally distributed.

Var. *gemmiferum* (Bréb.) Nordst. 5.

WK. Berkswell.

Var. *emarginatum* (Hansg.). 1.

WS. Trimpley, rare.

Var. *mediolæve* West. 10.

ST. Great Barr Park.

Var. *depressum* W. & G. S. West. 1.

WS. Trimpley.

C. ochthodes Nordst. 2–5, 7, 8, 10, 12.

WK. Bracebridge and Longmoor Pools, Sutton Park; Berkswell. WS. Quinton, in a small pond; Hartlebury Common.

Var. *amœbum* West. 5, 7.

WK. Longmoor Pool and Bogs I and II, Sutton Park; Berkswell.

C. conspersum Ralfs. 7–9.

WK. Longmoor Pool and Bog II, Sutton Park.

Var. *latum* W. & G. S. West (= *C. latum* Bréb.). 11.

WK. Bracebridge Pool, Sutton Park.

C. biretum Bréb. 6, 11.

WK. Plankton of Bracebridge Pool, Sutton Park.

Var. *trigibberum* Nordst. 9–11.

WK. Bracebridge Pool, Sutton Park. WS. King's Norton.

XANTHIDIUM Ehrenb.

X. armatum (Bréb.) Rabenh.

WK. Sutton Park, *A. W. Wills.*

X. antilopæum (Bréb.) Kütz. 4, 5, 10.

WS. Hawkesley Hall Farm, King's Norton.

X. cristatum Bréb.

WK. Sutton Park, *A. W. Wills.*

ARTHRODESMUS Ehrenb.

A. convergens Ehrenb. 5, 7, 10, 11.

WK. Bracebridge and Longmoor Pools, Sutton Park; Berkswell. WS. Hawkesley Hall Farm, King's Norton.

A. Incus Hass.

Var. *Ralfsii* W. & G. S. West. 4, 5.

WK. Berkswell; Knowle.

f. *minor* W. & G. S. West.

WK. Sutton Park, *A. W. Wills.*

STAURASTRUM Meyen.

S. Dickiei Ralfs. 5, 6, 10.

WS. Hawkesley Hall Farm, King's Norton.

S. dejectum Bréb.

WK. Sutton Park. *A. W. Wills.*

S. granulosum Ralfs. 10.

WS. Hawkesley Hall Farm, King's Norton.

S. lunatum Ralfs. 5.

WK. Berkswell.

S. brevispinum Bréb. 4, 5, 7, 10, 11.

WK. In plankton, Sutton Park. WS. Hawkesley Hall Farm, King's Norton—in conjugation, *W. J. H.* ST. Warley.

S. cuspidatum Bréb. 1, 12.

WK. Plankton of Bracebridge Pool, Sutton Park.

S. Avicula Bréb. 1–5, 7–12.

WK. Bracebridge Pool, Sutton Park. WS. Stapenhall Farm, King's Norton.

Var. *subarcuatum* (Wolle) West. 5, 6, 11.

=var. *verrucosum* West.

WK. Plankton of Bracebridge Pool, Sutton Park (probably).

S. denticulatum (Näg.) Arch. 5.

WS. Halesowen.

S. hirsutum Bréb. 3, 7.

WK. Sutton Park, *A. W. Wills.* WS. Hartlebury Common.

S. pilosum Näg. 4, 6–12.

WK. Plankton of Bracebridge Pool, Sutton Park.

S. Brebissonii Arch. 4, 7.

WK. Longmoor Pool, Sutton Park; Harborne.

S. polytrichum Perty. 7.

WK. Longmoor Pool, Sutton Park.

S. asperum Bréb.

WK. Sutton Park, *A. W. Wills.*

S. orbiculare Ralfs. 7.

WK. Longmoor Pool and Bog III, Sutton Park.

This is probably var. *Ralfsii* W. & G. S. West.

S. punctulatum Bréb. 2–7, 10, 11.

WK. Longmoor Pool (f. *tetragona*) and Bogs I and II, Sutton Park; Olton; Berkswell; Earlswood. WS. Stapenhall Farm, King's Norton; Westhills; Warley; Quinton; Hartlebury Common. ST. Bearwood; Manley Hall, Weeford.

Var. *pygmæum* W. & G. S. West (=*S pygmæum* Bréb.). 5.

WK. Lapworth.

S. turgescens De Not. 7.

WK. Longmoor Pool, Sutton Park.

S. Meriani Reinsch. 7.

WS. Hartlebury Common.

S. alternans Bréb. 6, 7, 10.

WK. Plankton of Bracebridge Pool, Sutton Park.

S. dilatatum Ehrenb. 7.

WK. Longmoor Pool, Sutton Park.

Var. *obtusilobum* De Not. 3.

WK. Bracebridge Pool, Sutton Park.

S. Bieneanum Rabenh. 10.

WK. Plankton of Bracebridge Pool, Sutton Park.

S. muticum Bréb.

WK. Sutton Park, *A. W. Wills.*

S. curvatum West. 10.

WK. Plankton of Bracebridge Pool, Sutton Park.

S. hexacerum Wittr. 4–7.

WK. Bracebridge and Longmoor Pools, Sutton Park; Botanical Gardens, Edgbaston; Berkswell; Earlswood. WS. Stapenhall Farm, King's Norton.

S. muricatum Bréb. 7.

WK. Longmoor Pool, Sutton Park.

S. inflexum Bréb. 2, 4, 5, 10–12.

WK. In the plankton and in ditches, Sutton Park; Berkswell. WS. Hawkesley Hall and Stapenhall Farms, King's Norton.

S. polymorphum Bréb. 3, 5–12.

WK. Plankton of Bracebridge Pool and Bog II, Sutton Park; Lapworth. WS. Stourport and Kidderminster.

S. crenulatum Näg. 2, 5–11.

WK. Plankton of Bracebridge Pool, Sutton Park; Olton. WS. King's Norton; Stourport.

S. spongiosum Bréb.

WK. Sutton Park, *A. W. Wills.*

S. paradoxum Meyen. 1, 3, 5–10.

WK. Plankton of Bracebridge, Blackroot, and Powell's Pools, Sutton Park.

Var. *longipes* Nordst. 2, 5–11.

WK. In the same pools, Sutton Park.

f. *biradiata.* 6.

WK. Plankton of Bracebridge Pool, Sutton Park.

S. gracile Ralfs. 8–10, 12.

WK. Plankton of Bracebridge Pool, Sutton Park.

S. Manfeldtii Delp. 3, 6–10.

WK. Plankton of Bracebridge Pool; Windmill Pool, Shirley.

S. furcigerum Rabenh. 1–12.

WK. Plankton of Bracebridge Pool, Sutton Park. WS. Warley; Hawkesley Hall Farm, King's Norton.

S. margaritaceum (Ehr.) Menegh.

WK. Sutton Park, *A. W. Wills.*

S. sexcostatum Bréb. var. *productum* West. 7.

WK. Longmoor Pool, Sutton Park.

S. tetracerum Ralfs. 2, 4, 6, 10, 11.

WK. Windmill Pool, Shirley. WS. Stapenhall Farm, King's Norton.

COSMOCLADIUM Bréb.

C. constrictum Arch. 9–11.

WK. In the plankton, Sutton Park.

SPHÆROZOSMA Corda.

S. granulatum Roy & Biss. 5, 10, 11.

WK. In ponds, Berkswell. WS. Hawkesley Hall Farm, King's Norton.

S. excavatum Ralfs.

WK. Sutton Park, *A. W. Wills.*

SPONDYLOSIUM Bréb.

S. papillatum W. & G. S. West. 5.

WK. Plankton of Bracebridge Pool; Harborne, *W. J. H.*

Another species (unnamed) is recorded from Bracebridge Pool.

GYMNOZYGA Ehrenb.

G. moniliformis Ehrenb. (=*Didymoprium Borreri* Ralfs.).

WK. Sutton Park, *A. W. Wills.*

HYALOTHECA Ehrenb.

H. dissiliens (Sm.) Bréb. 1, 3–11.

WK. Bracebridge and Longmoor Pools, and Bogs II and III, Sutton Park; Berkswell; Knowle. WS. Warley; Hawkesley Hall Farm, King's Norton; Hartlebury Common.

f. *tridentula* Nordst. 4, 10.

WK. Bog III, Sutton Park.

f. *major* Delp. 12.

WK. Bog II, Sutton Park.

H. mucosa (Dillw.) Ehrenb.

WK. Sutton Park, *A. W. Wills.*

DESMIDIUM Ag.

D. Swartzii Ag. 1, 7, 10, 11.

WK. Longmoor and Bracebridge Pools, Sutton Park.

D. cylindricum Grev. (= *Didymoprium Grevillei* Kütz.).

WK. Sutton Park, *A. W. Wills.*

STEPHANOKONTÆ.

ŒDOGONIALES.

ŒDOGONIACEÆ.

BULBOCHÆTE Ag.

B. intermedia De By. 5.

WS. [King's Norton, in fruit, *W. J. H.*]

B. angulosa Wittr. & Lund. 10.

WK. Sutton Park, in fruit.

B. minor A. Br. 5.

WS. [King's Norton, in fruit, *W. J. H.*]

B. subintermedia Elfv. 10.

WK. Sutton Park, in fruit.

Species of *Bulbochæte*, not in fruit, are by no means infrequent, attached to *Equisetum limosum*, *Myriophyllum*, etc.

ŒDOGONIUM Link.

Œ. cryptoporum Wittr. 5, 6.

WK. Olton. WS. Pond near Hawkesley Hall, King's Norton; Westhills. ST. Bearwood.

Var. *vulgare* Wittr. 3, 4.

WK. Berkswell. WS. Warley.

Œ. crispum Wittr. 5.

WS. [King's Norton, *W. J. H.*]

Œ. varians Wittr. & Lund. 5.

WK. Coleshill.

Œ. irregulare Wittr. 2, 6.

WK. Harborne. WS. Westhills; zoogonidia germinating by the second method (see West, Algæ, i. p. 390).

Œ. Braunii Kütz. 5.

WS. King's Norton; Barnt Green.

Œ. macrandrum Wittr. 5.

ST. [Bearwood, *W. J. H.*]

Œ. Borisianum (Le Cl.) Wittr. 5.

WK. Harborne, *W. J. H.* Pond near Hawkesley Hall, King's Norton.

Œ. rugulosum Nordst. 5.

WS. [King's Norton, *W. J. H.*]

Œ. gallicum Hirn. 5.

WK. Coleshill.

Œ. rivulare (Le Cl.) A. Br. 1–12.

WK. Bracebridge Pool, Sutton Park, on *Equisetum limosum* (see West, Journ. Bot. 1912, p. 321, fig. 1, A).

Œ. fonticola A. Br. 6.

WK. Henley-in-Arden, on stones in a small stream (see West, *l. c.* 1912, p. 321, fig. 1, B–H).

Œ. echinospermum A. Br. 5.

WS. [Pond at Hawkesley Hall Farm, King's Norton, *W. J. H.*]

Œ. Boscii (Le Cl.) Wittr. 5.

WK. [Harborne, in pond, *W. J. H.*]

Œ. sphærandrium Wittr. & Lund. 5.

WK. [Pond at Harborne, *W. J. H.*]

Numerous species of *Œdogonium*, not in fruit and therefore not determinable with certainty, are very common everywhere, attached to aquatic plants in ponds.

HETEROKONTÆ.

CHLOROSACCACEÆ.

MISCHOCOCCUS Näg.

M. confervicola Näg. 3, 6.

WK. Sutton Park. WS. King's Norton, *W. J. H.* ST. Wolverhampton; Stafford, *A. W. Wills*.

BOTRYOCOCCACEÆ.

BOTRYOCOCCUS Kütz.

B. Braunii Kütz. 1–12.

WK. Ponds, Berkswell; Studley; plankton of Bracebridge Pool, Sutton Park. WS. Hartlebury Common; King's Norton. Mostly in the reddish-yellow colonies which were named *Ineffigiata neglecta* W. & G. S. West.

B. sudeticus Lemm. 3, 8.

WK. Blackroot Pool, Sutton Park. WS. Hartlebury Common.

CHLOROTHECIACEÆ.

CHARACIOPSIS Borzi.

C. turgida W. & G. S. West. 5.

WK. Whitacre.

C. saccata Carter in New Phytol. vol. xviii. 1919, p. 177. 4, 11.
WK. Yardley; Pool Hollies Wood, Sutton Park, on dead leaves of oak.

C. Naegelii (A. Br.) Lemm. 11.
WK. Pool Hollies Wood, Sutton Park.

CHLOROBOTRYDACEÆ.

BOTRYDIOPSIS Borzi.

B. arrhiza Borzi. 4.
WK. Berkswell.

CHLOROBOTRYS Bohlin.

C. regularis (West) Bohlin. 4, 5, 7–10, 12.
WK. Bogs I and III, Sutton Park.

CENTRITRACTUS Lemm.

C. belonophorus (Schmidle) Lemm. 7.
WK. Berkswell—remarkable.

OPHIOCYTIACEÆ.

OPHIOCYTIUM Näg.

O. parvulum (Perty) A. Br. 3–7, 10.
WK. Hampton-in-Arden; Berkswell; Chelmsley Wood; Knowle; Bog III, Sutton Park. WS. Hartlebury Common; Hawkesley Hall Farm, King's Norton. ST. Great Barr Park.

O. majus Näg. 2–8, 10, 11.
WK. Coleshill; Whitacre; Henley-in-Arden; Hampton-in-Arden; Berkswell; Chelmsley Wood; Bracebridge and Bog III, Sutton Park. WS. Fenny Rough; Westhills; Barnt Green; Hawkesley Hall Farm, King's Norton. ST. Barr Beacon.

O. Arbuscula (A. Br.) Rabenh. 5, 10.
WK. Henley-in-Arden; Berkswell.

O. bicuspidatum (Borge) Lemm. 10.
WK. Bracebridge Pool, Sutton Park.

Ophiocytium cochleare A. Br. is recorded by *A. W. Wills* for the district.

TRIBONEMACEÆ.

TRIBONEMA Derb. & Sol.

T. bombycinum (Ag.) Derb. & Sol. 1–7, 10, 11.
Very common and generally distributed.

f. *minor* (Wille) G. S. West. 2–7, 10, 11.
Frequent, usually with the type.

T. affine (Kütz.) W. & G. S. West. 4, 5, 9, 10.
WK. Coleshill; Berkswell; Bog II, Sutton Park. WS. Quinton; Wyre Forest.

T. utriculosum (Kütz.) Hazen. 4.
WK. Knowle—very remarkable.

BUMILLERIA Borzi.

B. exilis Klebs. 5, 6.
WK. Edgbaston, from several localities; Harborne; Gravelly

Hill. In pond, Berkswell. WS. Warley; California; Northfield; Chadwick. ST. Sedgley; Gospel End; Baggeridge; Himley; Tettenhall.

First records for the British Islands. All the specimens, except those from Berkswell, were obtained from cultures of soil. (See Bristol, Annal. Bot, 1920, xxxiv. 78, text-fig. 1.)

BOTRYDIACEÆ.

BOTRYDIUM Wallr.

B. granulatum (L.) Grev. 6–8.

WK. Tanworth-in-Arden. WS. King's Norton; Hunnington; Blackwell.

RHODOPHYCEÆ.

PORPHYRIDIUM Näg.

P. cruentum (Ag.) Näg. 3–6.

WK. Edgbaston, on damp walls. WS. Hartlebury; Northfield, on the churchyard-wall, etc.

SACHERIA Sirod.

S. mamillosa Sirod. 4.

Recorded from Bridgnorth, Salop.

S. fluviatilis (Ag.) Sirod.

[Recorded by *A. W. Wills* as "common in the Avon and Severn."]

BATRACHOSPERMUM Roth.

B. moniliforme Roth. 5, 6, 10, 11.

WK. Bracebridge Pool, Sutton Park, with cystocarps in abundance almost every year.

WS. Halesowen, *W. J. H.*

B. atrum (Dillw.) Harv.

WS. [Halesowen, *A. W. Wills.*]

CHANTRANSIA Fr.

C. chalybea (Lyngb.) Fr. 6.

WS. Clent.

Summary of Species.

Flagellata	33
Myxophyceæ	83
Peridinieæ	14
Bacillarieæ	155
Chlorophyceæ	444
Rhodophyceæ	6
Total	735

Chlorophyceæ:—	
Isokontæ	181
Akontæ (including 196 Desmids)	226
Stephanokontæ	18
Heterokontæ	19
Total	444

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Printed by Taylor and Francis, Red Lion Court, Fleet Street.

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